APPLIED HYDRAULICS

NOVEMBER 1955

FRANCHISE CIRCULATION

THE MAGAZINE OF
FLUID POWER
INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

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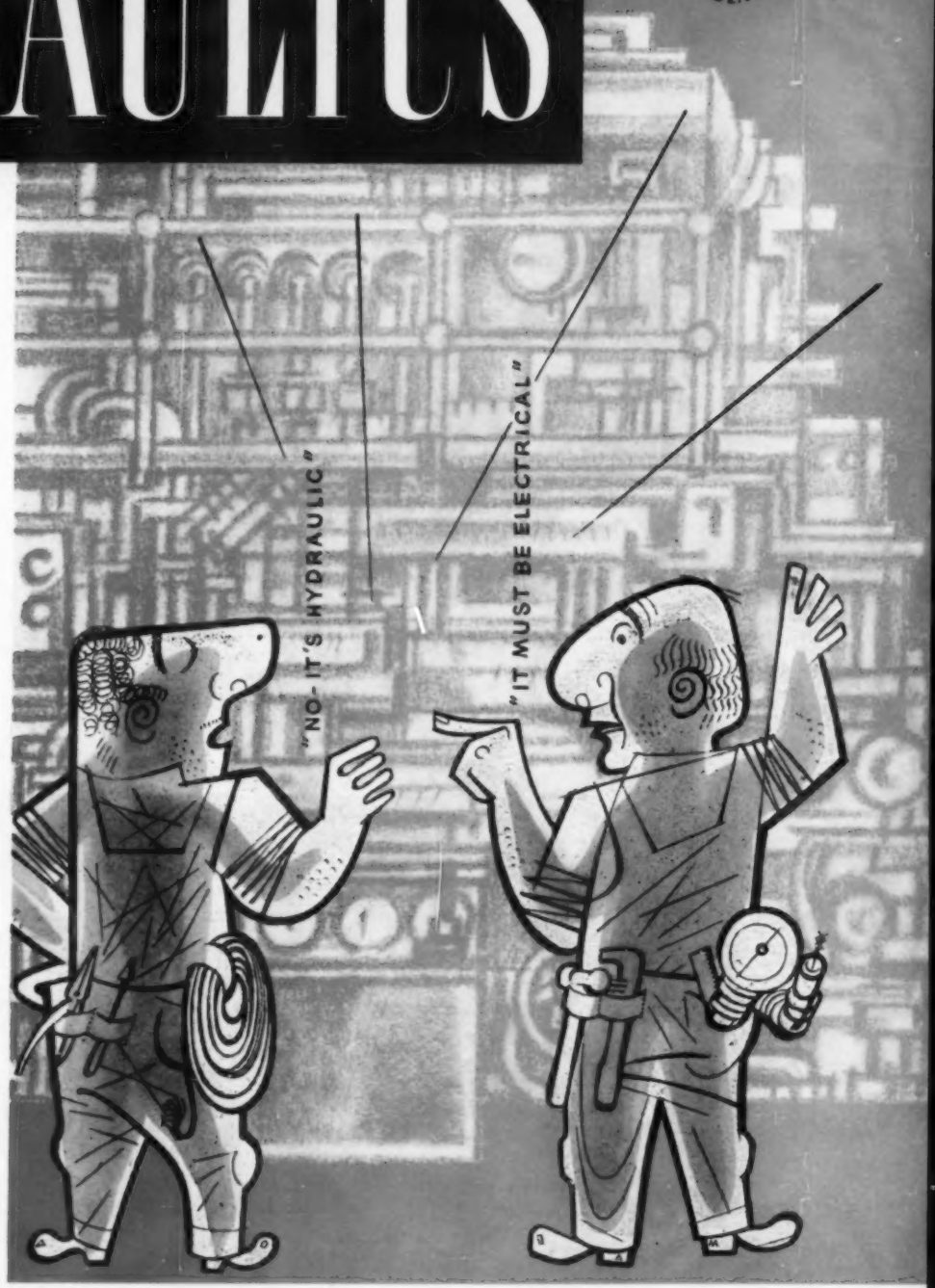

For more information about
THE MASTER CATALOG OF FLUID POWER PRODUCTS
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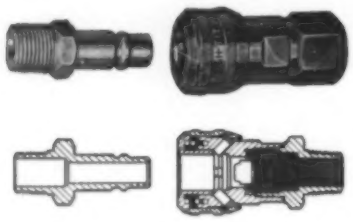
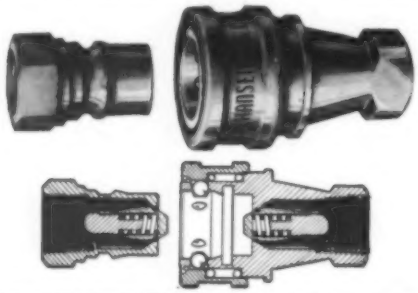
NEVER MERELY ADAPTED...
FOR EACH PARTICULAR
TYPE OF APPLICATION

HANSEN
QUICK-CONNECTIVE COUPLINGS



ONE-WAY SHUT-OFF
Shuts off one side of line

Gives quick connection and disconnection, with instant automatic flow or shut-off. To connect Coupling and open line to flow of fluid, merely push Plug into Socket. To disconnect, a slight pull on sleeve releases Plug and shuts off supply end of line.



TWO-WAY SHUT-OFF
Shuts off both sides of line

To connect, pull back sleeve and push Plug into Socket. Identical torpedo type valves permit free flow of gas or liquid through Coupling. To disconnect, pull back sleeve . . . Coupling immediately disconnects, valves automatically seal both ends of line. Female pipe thread connections from ⅛" to 1". Available in brass or steel.

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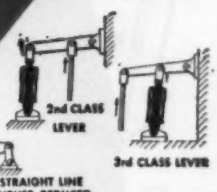

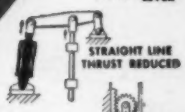

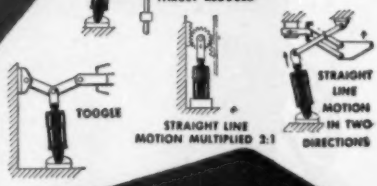

here are basic Cylinder Powered MECHANICAL MOVEMENTS that can be put to work for YOU!

IF YOU HAVE a push, pull, lift, press, clamp or control problem, Hanna Cylinder Power can be the answer. The mechanical movements here illustrated may suggest ways Hanna Cylinders can be used to simplify the actuation and control of machines or equipment and to replace or reduce manual effort.

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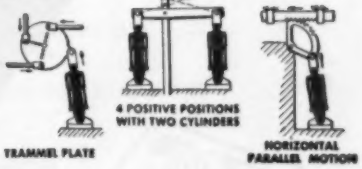

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VOLUME 8 NUMBER 11

NOVEMBER 1955

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BPA

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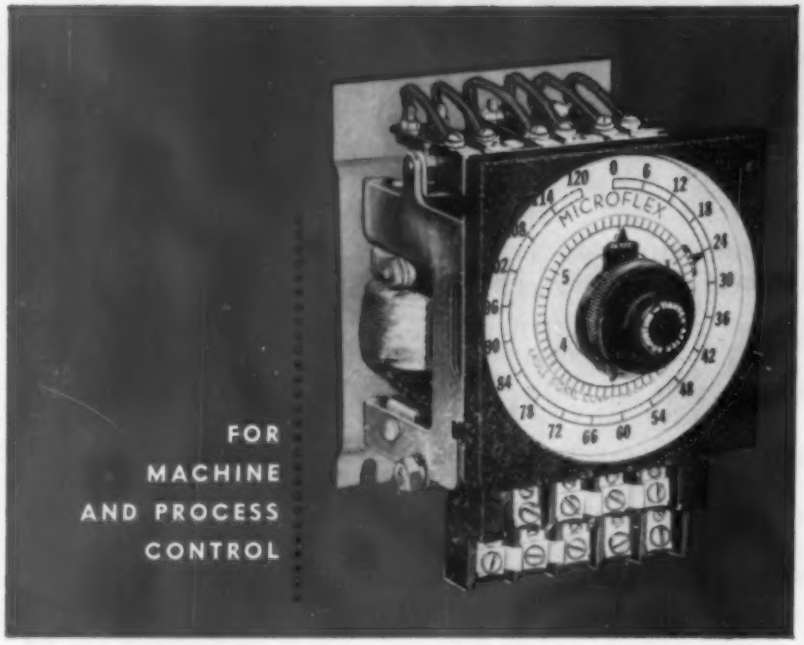
EAGLE
Microflex Reset Timer



Insures "20-to-1 ratio" accuracy

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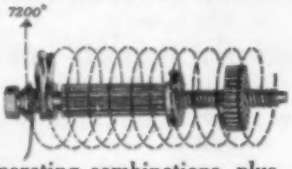

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Bulletin No. 300 gives you full information on complete "Duloc" Assemblies.

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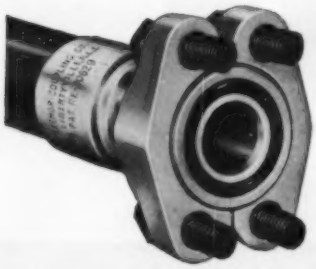
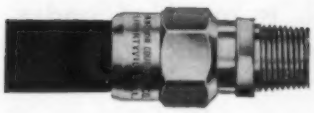


Anchor "Flanco" 4-bolt, Split-Flange Couplings.



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Anchor Clamp-type and Reusable Couplings and Hose Assemblies.

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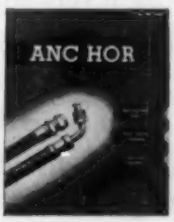

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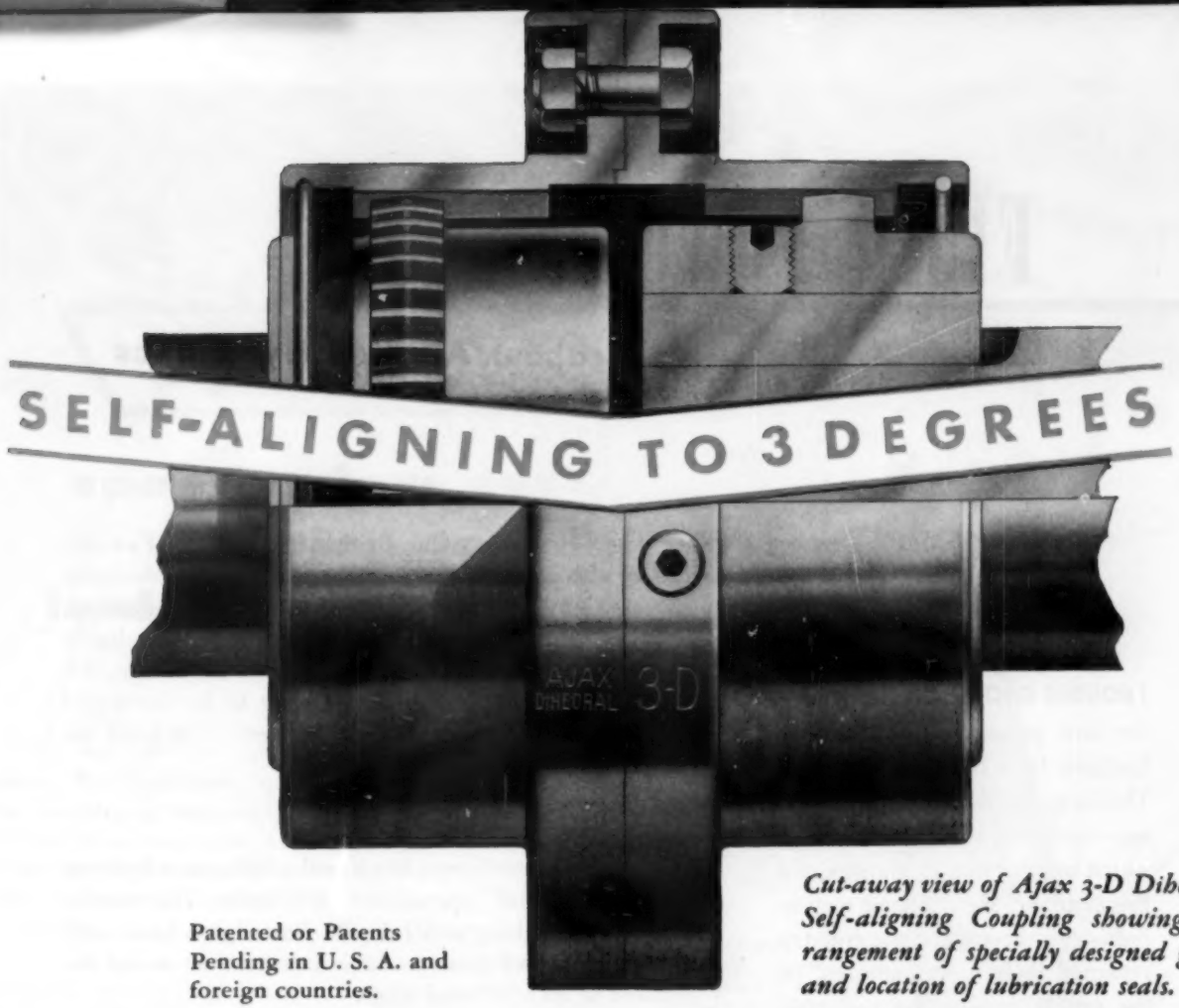

Patented or Patents Pending in U. S. A. and foreign countries.

Cut-away view of Ajax 3-D Dihedral Self-aligning Coupling showing arrangement of specially designed gears and location of lubrication seals.

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Fluid Power Lines

about Applied Hydraulics

TROUBLE SHOOTING . . . What's the best procedure for locating troubles in a hydraulic system? This is one of the questions which appeared on a questionnaire which we sent to 150 plants early this summer. Maintenance men in industries throughout the country returned their questionnaires. In the article opening on page 65, we have summarized their opinions, suggestions and techniques. Some of the men represent small job shops, others work in large high production plants. There is certainly no 100% agreement as to what components fail most often, what components should be kept on hand, or what should be replaced or repaired. But the exchange of ideas is valuable and many specific conclusions are made. At the end of the article we've tried our hand at making some. We want to thank all those who contributed to this survey.

PROBLEM CLINIC . . . Our British friend, John Fawcett, comes up with an answer to a problem which every designer faces some time in his career. Incidentally, Mr. Fawcett, who writes his articles in "British English" will probably be startled when he reads the blurb above his article. Although we wrote it as a quote, we want to let the world know that we weren't quoting Mr. Fawcett — at least not verbatim.

PISTON RINGS . . . They are often the difference between "good" or "no good" operation of a cylinder. This month, Ernest J. Taschenberg and John W. Pennington have written an article which presents basic information on the development of metallic seal rings.

MECHANIZING A NEWSPAPER . . . Many city newspapers turn out thousands of copies a day. To any production plant this rate of unit production is big and calls for a corps of industrial engineers to work out efficient handling techniques. Many newspaper plants, even those with modern high speed presses, are behind in applying modern methods to bundling and moving newspapers out of the plant. Here's a field for machine development which appears to be wide open. An article by Robert Miller describes the pneumatic and electric design on a newspaper feeder mechanism.

A CARTOON ON THE COVER! . . . We're real proud of this month's cover. The cartoon really tells the story about troubleshooting and also, we think it's attractive and eye catching. We would like you to meet our art director, Alaric Mausser, who prepared this month's cover. We usually give Alaric a sketchy idea and not enough time. Then he puts our very thin idea into excellent form and leads us to believe that we have master-minded the whole job —a very nice guy.

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Fluid Power Lines

continued

WATER WONDERLAND . . . Hydraulics is helping Michigan live up to their "water wonderland" slogan. The hydraulic dredge uses series connected fluid motors. Our article describing this design will give you ideas for the application of fluid motor drives.

1956/57 MASTER CATALOG OF FLUID POWER PRODUCTS . . . Yes, this giant 618 page catalog was published as scheduled on October 15th. The thousands of orders for copies are rapidly being filled. The hard covered catalog is thumb notch indexed into six sections. Section 1 is an index to all manufacturers of Fluid Power Products. In Section 2, 260 pages of manufacturers catalogs provide an important reference file of product specifications and information about their sales outlets.

For the user who knows a trade name and is searching for the manufacturer, Section 3 will help. Section 4 is a product index. Manufacturers of more than 600 products are listed.

A 180 page technical and engineering data section is a handbook for the fluid power field. This section details the design and selection of components for air and oil circuits. The final section, "Where to Buy Locally", lists local sales outlets throughout the United States and Canada. If you haven't gotten your copy, it can be ordered from us. The price is $6.50.

NEW AVIATION BOARD MEMBER . . . Articles in the Aviation Section of APPLIED HYDAULICS are suggested, selected and often written by members of the editorial advisory board. The newest member of this board is H. G. Conway, a Canadian, who studied in England. He joined the Messier organization in England in 1938 and remained with them as chief engineer and later technical director until 1953. In 1954 he was appointed chief engineer of Short Brothers and Harland Ltd., airplane manufacturers in Belfast. He is now a member of their board of directors. Mr. Conway is author of many articles on hydraulics and wrote the book *"Fluid Powered Mechanisms."*

H. G. Conway

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INSTALL STAYNEW HYDRAULIC AND BREATHER FILTERS

As Original Equipment on Your Hydraulic Machinery

Fit the filtering requirements of your hydraulic machinery to your specific needs by installing Staynew Hydraulic and Breather Filters.

Staynew HE Hydraulic Filter

Staynew BR Breather Filter

DOLLINGER PROTECTED DESIGN STAYNEW FILTERS

HYDRAULIC FILTERS

Compact, simplified filters for use wherever dirty liquids are collected, filtered or recirculated. Wide range of metallic mesh and fabric media are available. Long operation assured without cleaning or replacement.

BREATHER FILTERS

Permit practically constant interior pressure by allowing atmospheric air to be drawn in or exhausted as required—while preventing entrance of impurities and escape of liquid mist or fog.

When you build this perfect combination into your hydraulic machinery, you'll save costly equipment wear, spoilage, and maintenance time.

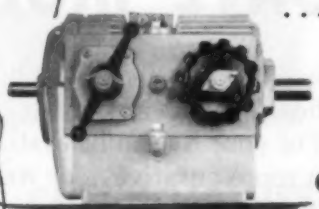
Let our Engineering Department solve your hydraulic filtration problems. Write today for Bulletin HF-2.

Representatives in Principal Cities

DOLLINGER CORPORATION, 65 Centre Pk., Rochester 3,.N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Reversibility...WOW!



. . . the humming bird reverses its wings an estimated 4500 times a minute . . . effortlessly. We don't claim that our variable speed transmission can top the humming bird's accomplishment, BUT . . . for the record, we reversed a GEROTOR VARIABLE SPEED HYDRAULIC TRANSMISSION (under load) over a million times — continuously, at a rate of 22 reversals per minute — without the slightest sign of wear.*

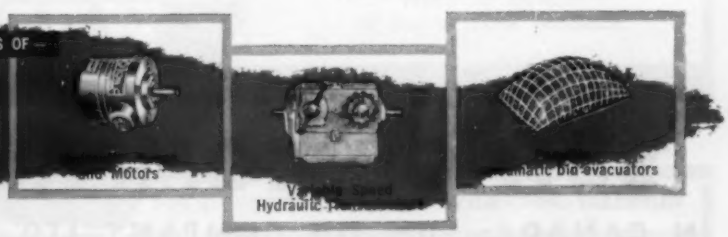
*. . . *doubt it?* Why not make us prove this and other outstanding features . . . send for literature TODAY.

MANUFACTURERS OF

GEROTOR

MAY CORPORATION

1535 MARYLAND AVENUE • BALTIMORE 3, MARYLAND



WHAT	WHERE	WHY
SUNVIS 900	**In tight systems** where oil is rarely changed and little or no make-up is needed.	**Exceptionally long life** of oil keeps overall costs low.
SOLNUS	**In tight systems** where make-up oil is less than 5% per month.	**Moderately priced**... excellent stability and rust protection.
SUNTAC	**In leaky systems** where make-up average is 5% or over per month.	**Reduced leakage** in systems cuts oil costs and downtime.
CIRCO	**In systems** where oil is continuously diluted by water, cutting fluids and other contaminants.	**Low-priced**... excellent protection where oil must be changed frequently.
SUNVIS H.D. 700	**In systems contaminated** by dust and deposits of sludge, varnish, etc.	**Cleansing action** removes deposits and eliminates costly teardowns.
LUBEWAY	**In dual purpose systems** of machine tools where hydraulic oil is also a way lubricant.	**Added film strength** of this hydraulic oil also eliminates "stick-slip" on ways.

CHART SHOWS WHERE AND WHY SUN HYDRAULIC OILS SAVE MONEY

As the chart shows, to operate your hydraulic system at maximum efficiency and minimum cost you must consider the condition of your hydraulic system, as well as pressures, operating temperatures and other usual factors.

And, very important, you must consider the age of your system. Continued use of original oil recommendations can be costly. A change in the type of oil can often result in substantial savings...especially where systems have developed leaks or where sludge and varnish cause excessive maintenance.

For complete information about how Sun hydraulic oils can help you cut operating costs of your hydraulic system, see your Sun representative...or write SUN OIL COMPANY, Philadelphia 3, Pa. Dept. AH-11.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

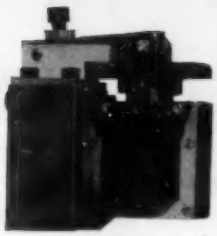
SUN OIL COMPANY PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

5 WATERMAN CONTROLS

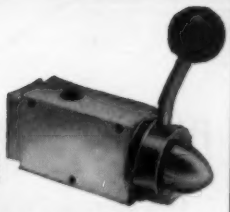
for accuracy—dependability—safety—low maintenance cost

SOLENOID VALVES



SOLENOID VALVES for working pressures to 3000 psi. Designed for remote control of hydraulic systems, and handling non-corrosive fluids. Poppet construction eliminates leakage. Impregnated coils are oil and moisture resistant. Available in 100-220 Volt A.C.

ADJUSTABLE FLOW REGULATORS



Full range Adjustable Flow Regulators from 0.5 GPM to 20 GPM. All Waterman Flow Regulators maintain a constant rate of flow regardless of work resistance or pressure fluctuations.

MICRONIC LINE FILTERS

Operating pressures to 3000 psi. 10 micron filtration. Replaceable elements. Available in 3/8" and 3/4" NPT.

CHECK VALVES

CHECK VALVES—one piece construction—no welds to crack. Nylon Poppet assures leak-proof service. Light weight aluminum body. Low pressure drop. Available in 3/8", 1/2", 3/4" and 1" NPT line sizes.

UNLOADING VALVES

UNLOADING VALVES for system pressure to 3000 psi. Flow rates to 30 G.P.M. Fast acting, easily adjustable, maintain desired pressure settings without continuous readjustment. Hardened poppets eliminate leakage. Large passages assure maximum flow with minimum pressure loss.

WATERMAN

ENGINEERING COMPANY

Write for bulletin of any of these products

725 CUSTER AVENUE • EVANSTON, ILLINOIS

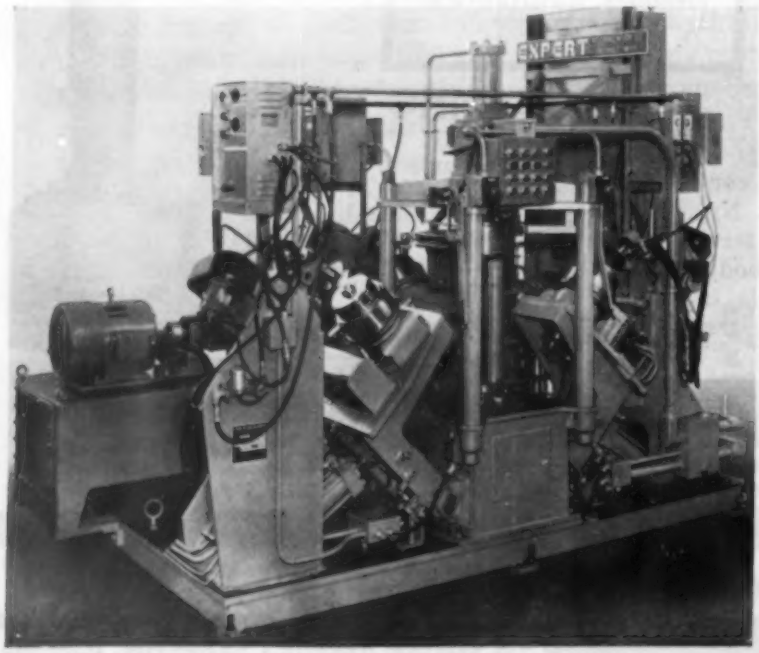
BRIEFS about fluid power

FLUID POWER INCREASES WELDING PRODUCTION

One operator can assemble and weld two 8-inch diameter sheet metal fluid coupling parts at a rate of 300 finished assemblies per hour on one of these machines, designed and built by Expert Welding Machine Company.

The machine consists of a special vertical hydraulic assembly press and three standard argon shielded-arc welding heads. High production rates are achieved by performing the welding operation on two fixtures while parts are being assembled in a third fixture by the press. Hydraulically controlled pivoted fixtures provide the required transfer and rotation movements. The three fixtures are pivoted at the base of the press. Individual hydraulic cylinders control the motion of the fixtures in and out of the press. Hydraulic motors rotate the assembled part and fixture as a unit during the welding operation.

A separate hydraulic power package supplies power for all control and operating functions. Separate electrical and welding control panels are provided. Individual operating buttons are provided for each fixture to facilitate setup operations. All fixtures are separately and independently operated, permitting the machine to continue to produce parts while one or two of the fixtures is locked out for maintenance. ▼▼▼



UL Lists Fluid

Pydraul F-9, a fire-resistant synthetic hydraulic fluid, developed by Monsanto Chemical Company, has become the first such fluid to be listed by Underwriter's Laboratories, Inc.

After more than a year of flammability tests, the fluid has been given a fire hazard rating of 2-3. The rating has been based on UL's standard of classification for fire hazard of liquids.

Underwriter's Laboratories, Inc., is sponsored by the National Board of Fire Underwriters and is that organization's official testing facility. ▼▼▼

Portable Pneumatic Lung To Treat Polio

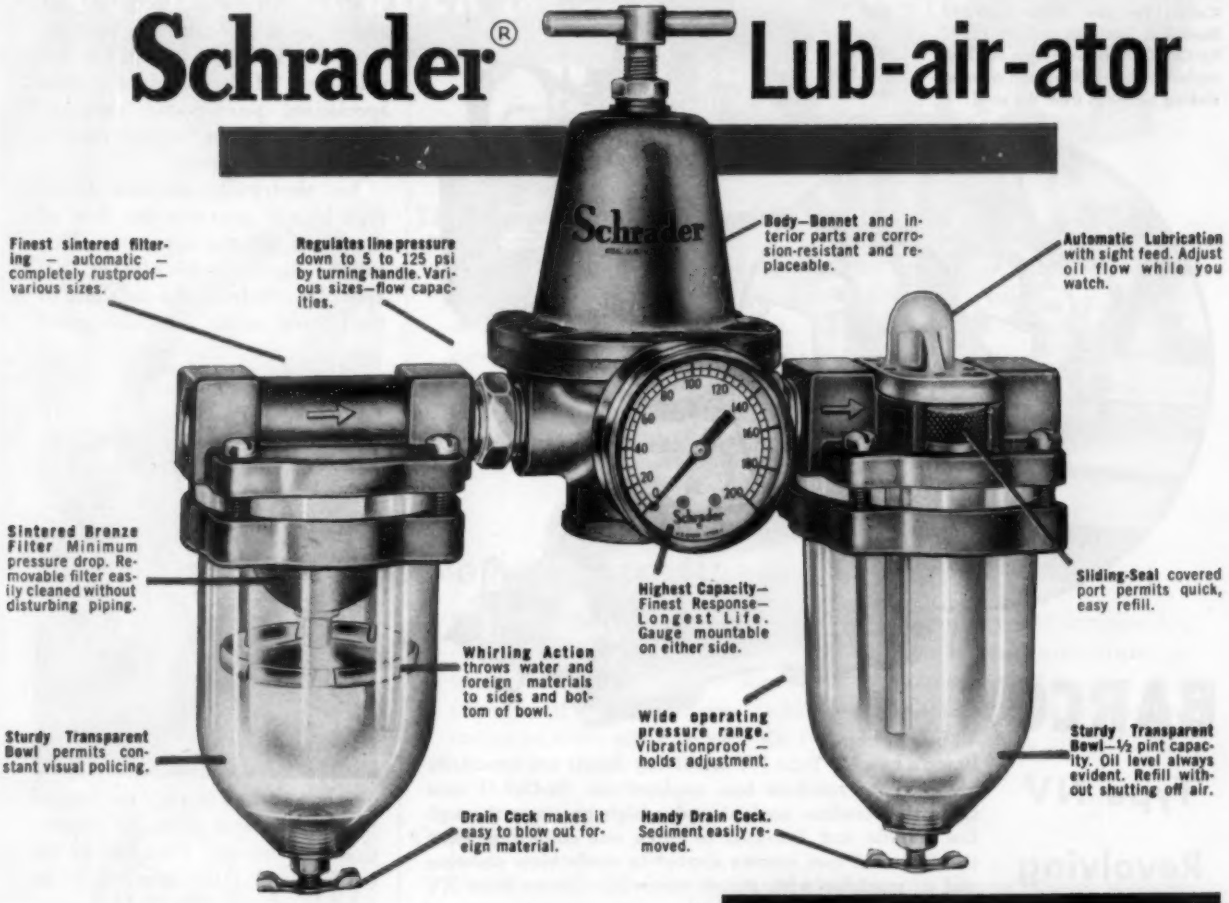
One big need, a small, portable breathing machine which is easy to operate and maintain has been met by a research program of a British laboratory. Electronic & X-Ray Applications Ltd., studied the physio-mechanics of breathing and investigated available pneumatic devices. The Tunicliffe Breathing Jacket, which converts the massive metal tank of the iron

Continued on page 18

NEW!

FILTER...REGULATE...LUBRICATE with this

Schrader® Lub-air-ator


Finest sintered filtering — automatic — completely rustproof — various sizes.
Regulates line pressure down to 5 to 125 psi by turning handle. Various sizes—flow capacities.
Body—Bonnet and interior parts are corrosion-resistant and replaceable.
Automatic Lubrication with sight feed. Adjust oil flow while you watch.
Sintered Bronze Filter Minimum pressure drop. Removable filter easily cleaned without disturbing piping.
Whirling Action throws water and foreign materials to sides and bottom of bowl.
Highest Capacity—Finest Response—Longest Life. Gauge mountable on either side.
Sliding-Seal covered port permits quick, easy refill.
Sturdy Transparent Bowl permits constant visual policing.
Wide operating pressure range. Vibrationproof — holds adjustment.
Sturdy Transparent Bowl—½ pint capacity. Oil level always evident. Refill without shutting off air.
Drain Cock makes it easy to blow out foreign material.
Handy Drain Cock. Sediment easily removed.

Easily maintained. No moving parts—can be serviced without disturbing pipe connections.

Now! An all-in-one installation! The Schrader LUB-AIR-ATOR. This new, quality unit is designed to do these three important jobs: *filter* clean the air as it moves through system—*regulate* air to proper pressure requirements—*lubricate* moving parts in the correct amount to minimize wear and friction. End result: your valuable air tools give longer trouble-free service.

Use a Schrader LUB-AIR-ATOR wherever you need dependable, safe air service. And . . . if you design products with air equipment and controls—"build in" the Schrader LUB-AIR-ATOR. Its quality complements *your* equipment. For a fully illustrated specification sheet write us! Act now! Address A. SCHRADER'S SON, Division of Scovill Manufacturing Company, Incorporated, 456 Vanderbilt Avenue, Brooklyn, New York.

Schrader
REG. U. S. PAT. OFF.

LEADERS IN AIR CONTROL SINCE 1844

An Aid to PRODUCTION!

EX-CELL-O

These pictures show how Ex-Cell-O Corporation uses Barco Type NV Revolving Joints on its Style 112-C Ex-Cell-O Precision Boring Machine tooled for Bor-Drilling and countersinking bushings from the solid.

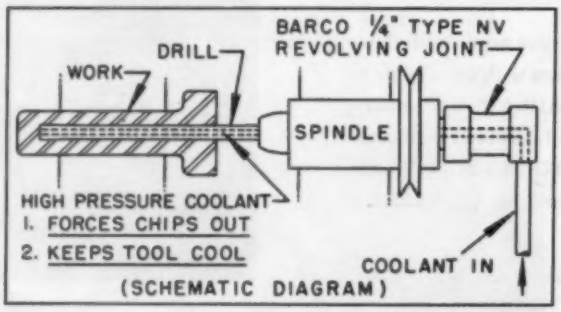
BARCO

Type NV Revolving Joints

Barco's new ¼" Type NV Revolving Joints are especially designed for machine tool applications. Ex-Cell-O uses them to introduce coolant under high pressure through the spindle and Bor-Dril to force out chips and keep the tool cool (see arrows above* in circle view showing end of machine with guard removed.) Barco Type NV Joints are well-suited for this application because of their precision construction and compact design. Sealed internal ball bearings are lubricated for life. Exclusive V-ring seals are self-adjusting for wear, require no lubrication, and permit operating speeds as high as 2500 RPM. Joints are suitable for use on pressures to 300 psi (air) or 1500 psi (hydraulic). Temperatures to 180° F. *Send for complete information and BULLETIN 307.*

**Alternate spindles do countersinking operations, and do not require coolant through the spindles.*

ASK FOR BULLETIN 307



BARCO MANUFACTURING COMPANY
532M Hough Street • Barrington, Illinois

BRIEFS continued

lung into a lightweight fabric jacket was the first major step.

Mr. C. Densham, technical director of the Wade Engineering Company Ltd., assisted in the development of the required highly specialized pneumatic package. Weight of the new "nylon" lung is less than 80 pounds.

An electrically driven Roots type blower provides the flow of air to operate the apparatus. This blower displaces 40 cfm at 300 rpm. Driven from the tailshaft of the electric motor, a variable speed

gearbox is used to vary the rate of respiration from 10 to 30 respirations per minute. Attached to the output end of the gearbox is an interchangeable cam, which actuates a rotary type valve. The purpose of this valve is to transpose the inlet and outlet ports of the blower and connect them alternately to the flexible nylon pipe leading to the nylon jacket. This jacket is designed to allow a certain amount of air to escape around the neck to give a more satisfactory ventilation than is possible with the completely sealed-off iron lung.

If the electrical drive fails, a manually operated pump can take over.—J.A.L. ▼▼▼

A Discussion . . .

. . . of our nation's heavy press program—past, present and future—will highlight the technical sessions of the 1955 A.S.M.E. Aviation Division Meeting on November 14 at Chicago. These sessions

Continued on page 22

You can count on the exceptional **KNOW-HOW** *of*

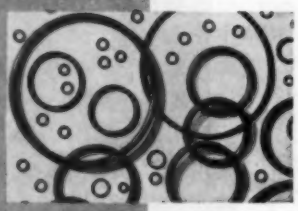
GOSHEN RUBBER *for* . . . . . JOB-RIGHT SEALING

TETRASEAL RECTANGULAR SECTION RINGS

In static applications TETRASEALS may save you money and grief over the type you're now using. They're non-laminated (in one homogeneous piece), and edges are accurately formed. What's more, cross-sectional tolerances can be held to ± .004 depending on inside and outside diameter, on size of cross-section and on material desired. Now available in materials to meet MIL, AMS, and commercial specifications. To find out what TETRASEAL can do for you, write for Technical Bulletin No. 11.

ENGINEERED COMPOUNDS

Finest facilities and technical know-how are constantly at work compounding materials and fabricating custom-designed parts to meet ever stricter requirements. Recent Goshen developments include synthetic rubber compounds, other than silicones, which withstand such severe temperature ranges as minus 65° F. to plus 300 F°.; and minus 20° F. to plus 400° F.

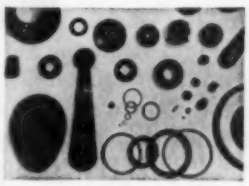


O-RINGS

Precisely molded O-rings, of natural, snythetic, and silicone rubbers, specially compounded by Goshen, to MIL, AMS, and commercial specifications, are helping cope with today's greater temperature range, higher pressures, and wide variety of acids, gases, and chemicals. When it comes to O-rings, let Goshen be your dependable source.

NATURAL, SYNTHETIC, AND SILICONE RUBBER PARTS AND COMPONENTS

Custom-Made to your exact specifications . . .



In addition to precision seals, Goshen produces a wide range of custom-designed parts of carefully compounded materials. Parts are not stocked, but are fabricated only on order to meet your strictest requirements as to compound, service life, and operating satisfaction.

Send for Literature: ☐ **TETRASEALS** ☐ **GORLUBE (Low Friction Treatment)** ☐ **O-RINGS** ☐ **GOSHEN'S CUSTOM FACILITIES**

Goshen Rubber Co. INC. *Goshen, Ind.*

CUSTOM DEVELOPMENT AND FABRICATION SINCE 1916

1511-5 S. TENTH ST.

at no extra cost to you . . .

NEW Quality Features on All AIR and HYDRAULIC CYLINDERS

CASE HARDENED CHROME PLATED PISTON RODS
On all Miller Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences.

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust.

"TEFLON" WIPERS
On all Miller Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Seals withstand temperatures from —100° F. up to 500° F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use.

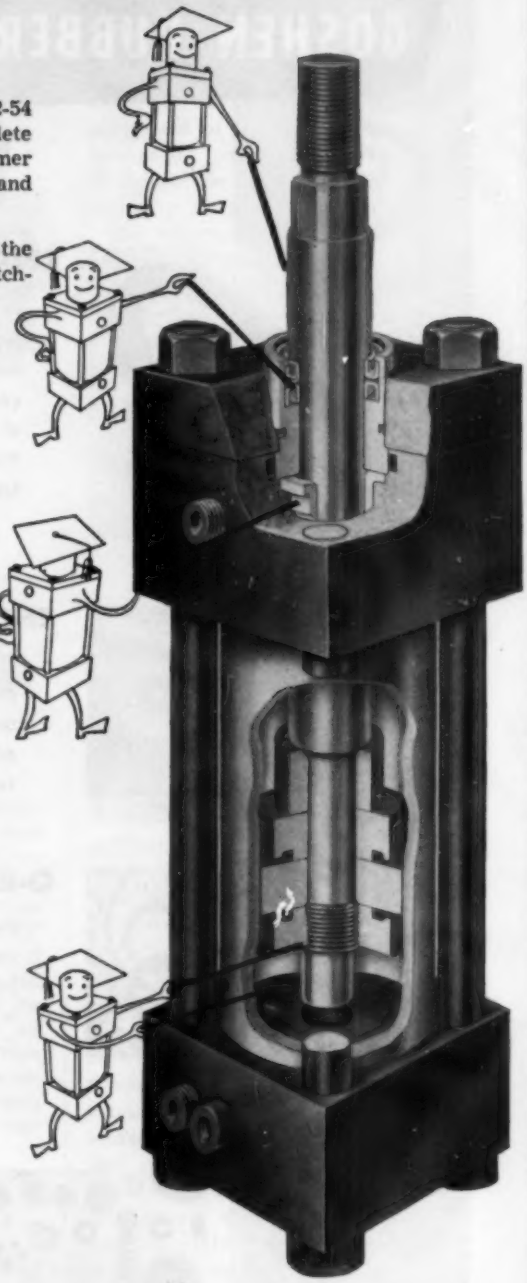
"TEFLON" HYDRAULIC ROD SEALS
On all Miller Hydraulic Cylinders only

RUST RESISTANT SURFACES
On all Miller Air and Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, and the unplated portions of the piston rods have this finish. It is not recommended for water service.



WRITE FOR CYLINDER BULLETINS H-104 and A-105

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

Over 8,000 Different Cylinder Selections Available for Immediate Delivery. Write for Complete List.

EFFECTIVE DATES

These new Miller features will be provided at no extra cost after January 1, 1956—and at Miller's option prior to that date.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • TOLEDO • CINCINNATI • COLUMBUS
PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY
BUFFALO • ROCHESTER • MINNEAPOLIS • GRAND RAPIDS • DETROIT • FLINT
FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE
KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE
DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • ATLANTA
TORONTO, CANADA and OTHER AREAS

MILLER FLUID POWER CO.

2008 N. Hawthorne Ave. Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

Four More Miller Firsts . . .

Our "Report To Cylinder Users" was a simple statement of Miller Fluid Power Company's policy. In it was mentioned our dedication to the constant improvement of our products.

In line with this policy, here are new quality cylinder features that will eliminate many of the problems which you have reported to us.

Miller gave cylinder users one of its firsts when we chrome-plated all cylinder piston rods. Our reason was obvious. Chrome-plating gave every rod a mirror-like finish that no corrosive or abrasive dust could scratch. Miller made this chrome-plated, longer lasting rod standard. AT NO EXTRA COST.

Preventing Damage To Piston Rods

There were still plenty of hazards to which piston rods were subjected. A careless workman with a too handy wrench or pair of pliers meant a scored piston rod. A falling object striking the rod dented the softer metal beneath the plating of chrome. A jolt during assembly left its trouble-breeding mark. All of these nicked and scored the piston rods, damaging the whole assembly. Little could be done about this beyond repair and replacement—until the Miller announcement that from now on the piston rods on all cylinders—air and hydraulic—will be specially hardened (52-54 Rockwell C) to foil the carelessly used tool, the accident in transit or assembly, the falling object or unnoticed knock. Naturally, the new hardened rods will still be chrome-plated. Miller will now make this super quality an everyday standard. AT NO EXTRA COST.

Meeting The Challenge Of The New Demands On Seals

Rod seals on Miller hydraulic cylinders were constructed to be leakproof under all ordinary operating conditions. We guaranteed this. But we also stated in all our catalogues that for special conditions there must be special rod seals at an extra cost. Rod seals to withstand high temperatures had to be specially constructed. Where fire resistant fluids were used, special rod seals had to be provided at an extra cost. Because many fire resistant fluids destroy ordinary packing.

The present widespread use of these fluids and excessive heat generation from high speed operation and increased loads have resulted in reports of trouble on cylinders where ordinary seals were subjected to these hazards. These reports were not received with joy at Miller, even when the fault was definitely not ours. We don't like to have trouble develop on any Miller installation under any condition. So we decided to do something about these problems of the rod seals.

A new expensive material known as "TEFLON" has been developed for use as seals. This material is impervious to temperatures from —100° to plus 500° F. It resists all known fluids, even the most destructive of the fire resistant fluids. Now, every piston rod on every Miller hydraulic cylinder will be fitted with "TEFLON" Piston Rod Seals. AT NO EXTRA COST.

In addition, all rod wiper seals on all Miller Air and Hydraulic cylinders will be of the same chemical-and-heat resisting Teflon material.

These Teflon rod wiper seals will be standard on every Miller cylinder, regardless of how and where it will be used. This is Miller's way of doubly insuring cylinder users against all possible hazards. AT NO EXTRA COST.

Protection Against Rust

The barrels of Miller air cylinders are of moisture-resistant brass. The barrels of hyraulic cylinders, since they run in oil, are protected once they are installed and in operation. Beyond this all cylinder parts are subject to rust and corrosion. Such exposed parts as heads, caps and tie rods quickly show the unsightly evidences of rust. At least this has been so up till now. But all this is now being corrected.

From now on Miller will protect all these parts on both air and hydraulic cylinders with a black oxide process in which a chemically created ferric oxide coating is developed on the surface of the metal to protect against rust and other corrosion. Every Miller cylinder sold will carry this added protection. AT NO EXTRA COST.

These four new Miller firsts are added to the many firsts established by Miller. Like other Miller firsts which created new departures in cylinder design and construction, these are now offered as Miller standard specifications. AT NO EXTRA COST.

MILLER FLUID POWER COMPANY
2008 N. Hawthorne Avenue
Melrose Park Illinois

TUTHILL SIMPLIFIES PUMP SELECTION

New Cataloging Plan Provides Practical Short-Cuts to Pump Specifications — Helps You Pick The Right Pump for the Purpose

If Your Specifications Call for Pumps for...

- LUBRICATION
- COOLANT
- TRANSFER
- CIRCULATING
- BURNING OILS

In capacities from 2 to 200 g.p.m. and pressures up to 100 p.s.i.

...Write for Tuthill Catalog 102

Catalog 102 offers complete data on the Model C series of rotary, internal-gear positive displacement pumps for general use in handling non-corrosive liquids with lubricating qualities.

TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Illinois

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd. • Ingersoll, Ontario, Canada

BRIEFS continued

are part of the A.S.M.E. General Meeting which runs November 13-18, and are designed to tie in with the theme of this 75th anniversary Diamond Jubilee Meeting "The Engineer in the World of Commerce & Industry". Aviation Division executive committee chairman is F. T. Harrington, vice-president sales, of Vickers, Incorporated. ▼▼▼

Plastic Steel For Rebuilding Parts

A combination of 80 percent steel and 20 percent plastic, known as Devcon, has been introduced by the Chemical Development Corporation. This product is as easy to handle as modeling clay and after

addition of special hardening agent, it becomes a rigid, strong steel like mass. No heat or pressure is required. There is practically no shrinkage during hardening and once set it is durable and permanent.

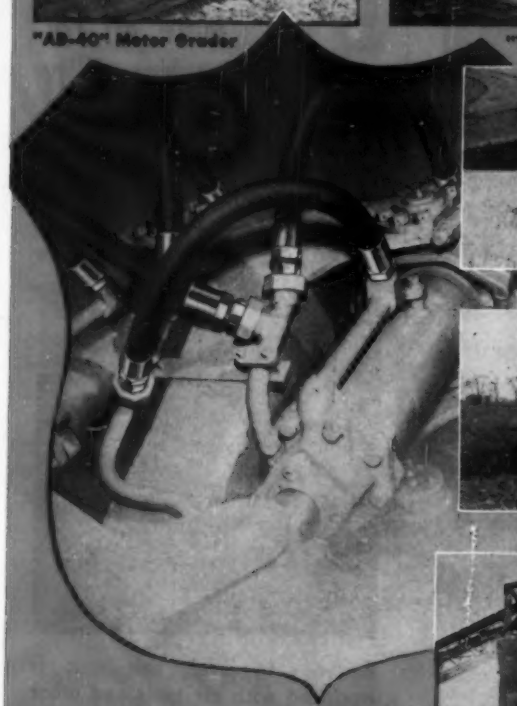
Originally developed for use in the metal working industry it is

Continued on page 24

Eastman HYDRAULIC HOSE ASSEMBLIES DELIVER MOBILE POWER *for* ALLIS-CHALMERS

"AB-40" Motor Grader

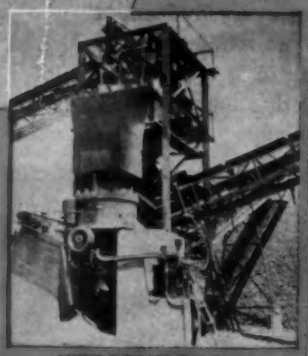
"TS-300" Motor Scraper



Eastman Hydraulic Hose Assemblies used on steering ram of Allis-Chalmers TS-300 and TS-360 Motor Scraper. Also used on TS-200 Series to control steering, plus apron, ejector and bowl action—applying down pressure when loading equal to the weight of the scraper—38,560 lbs.!

ALL-CROP Harvester

"WD-45" Tractor



HYDROCONE Crusher

GLACIERS NEVER HAD IT SO EASY . . .

The millions of years required by the glaciers to scour and alter the earth diminish to mere minutes when Allis-Chalmers earth moving and grading machinery go to work. Many of these mighty machines owe much of their ease of operation and maneuverability to hydraulic power—delivered through **EASTMAN** Hydraulic Hose Assemblies.

TODAY'S FARM YOUTH NEVER BORN "30 YEARS TOO SOON"

Milestones in farm mechanization are marked by Allis-Chalmers farm machinery. Pioneering in many farming innovations resulted in such exclusive firsts as the ROTO-BALER, ALL-CROP Harvester, Rear-Engine Tractor—Power Shift Wheels, SNAP-COUPLER and Hydraulic Traction Booster. Much of the operation and control of this world famous line of farm machinery is done through hydraulic power—also applied through **EASTMAN** Hydraulic Hose Assemblies.

NATURE NEVER CRUSHED ROCK LIKE THIS . . .

Hydraulic power on the HYDROCONE crusher affords "one man, one minute" product size control. It provides a rapid and convenient means of raising or lowering the crushing head. It permits compensation for wear and facilitates emptying the crushing chamber in case of power failure or for the quick release of uncrushable materials. Allis-Chalmers pioneered in this type of crusher—as **EASTMAN** pioneered in Hydraulic Hose Assemblies.

TURN TO EASTMAN for *your* Hydraulic Hose Assemblies, too. Whatever your requirements, always get your first recommendation from **EASTMAN** . . . *first in the field.* Exclusive designs, advanced engineering, unequalled production facilities and efficiency—mean unequalled economy, performance and constant customer satisfaction for you.

Eastman

first in the field

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

EASTMAN MANUFACTURING CO.
Since 1914
Dept. AH-11, Manitowoc, Wisconsin

WRITE *for free Catalog 101 on Eastman Hose Assemblies*

Brute Strength or Delicate Handling of Rotary Power Functions . . .

TWO VANES ARE BETTER THAN ONE

The hydraulically balanced DUAL-VANES in DUDCO Fluid Motors, as contrasted with conventional designs, maintain MULTIPLE AREAS OF CONTACT ON THE CAM RING . . . doubling the number of effective barriers to slippage and power loss. This patented principle is an exclusive DUDCO feature!

DUDCO

FLUID MOTORS

Compact and sturdy, DUDCO DUAL-VANE Fluid Motors operate quietly and smoothly under the most strenuous conditions. They're built to "take it" . . . frequent reversals, rapid accelerations or stalling under load. With DUDCO you get the big advantage of 2000 psi operation at a cost comparable with that of lower pressure equipment.

DUDCO is a big, exciting story for every hydraulics engineer because . . . power losses are minimized and operating efficiency is higher . . . starting torques are high . . . operation is smooth, quiet and exceptionally free from wear or maintenance problems.

On Conveyor systems for agricultural, food processing, mining and other industries, DUDCO DUAL-VANE Fluid Motors provide the extras in performance that save time, money and labor. Operating

the winches on a giant tank retriever and other large mobile equipment calls for high starting torque and the dependable power of DUDCO DUAL-VANE MOTORS.

Write for Bulletin DM-301 fully describing DUDCO DUAL-VANE Fluid Motors today!

DUDCO DIVISION

THE NEW YORK AIR BRAKE COMPANY

1704 EAST NINE MILE ROAD • HAZEL PARK • MICH.

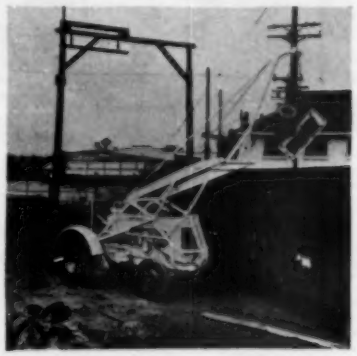
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

BRIEFS continued

also now used by automotive and aircraft companies for making forming or stamping dies for metal, bonding steel to itself or to aluminum, brass, bronze and iron, filling holes in castings, building up the inside of pumps, valves and other worn sections and rebuilding broken machinery. ▼▼▼

More Air For Greater Versatility

A 125 cfm air compressor has been installed on the new Tractair models made by the Le Roi Division of Westinghouse Air Brake Company. Designed to bring compressed air power to otherwise



hard-to-get places, this unit is equipped with air tools and other attachments for a variety of work. Railroads find this unit very practical since it can easily bring air to remote places for track maintenance. ▼▼▼

New Ships Install Hydraulic Hatches

U. S. Gypsum Co. and Oceanic Steamship Co. have contracted for the installation of hydraulic hatches on two carriers and two passenger liners respectively. These devices, known as Hydro-Hatches, are manufactured by Greer Marine Corp., subsidiary of Greer Hydraulics, Inc.

The unit consists of four hinged sections which are opened by hy-

draulic power and folded in accordian style, leaving a clear opening. Use of this device will bring savings in operating time and expenses as the unit only takes three minutes to close compared with 20 minutes required by present operation. The ship's boom, winches, removal of tarpaulins, loosening of wedges and prying loose locking bars are now required for a conventional hatch opening. ▼▼▼

1956 ASTE Annual Meeting

A most comprehensive series of technical sessions are planned for the 1956 Annual Meeting and Exposition of The American Society of Tool Engineers to be held March 19-23 at the International Amphitheatre, Chicago, Illinois. The program will comprise around 60 papers to be presented in 30 sessions.

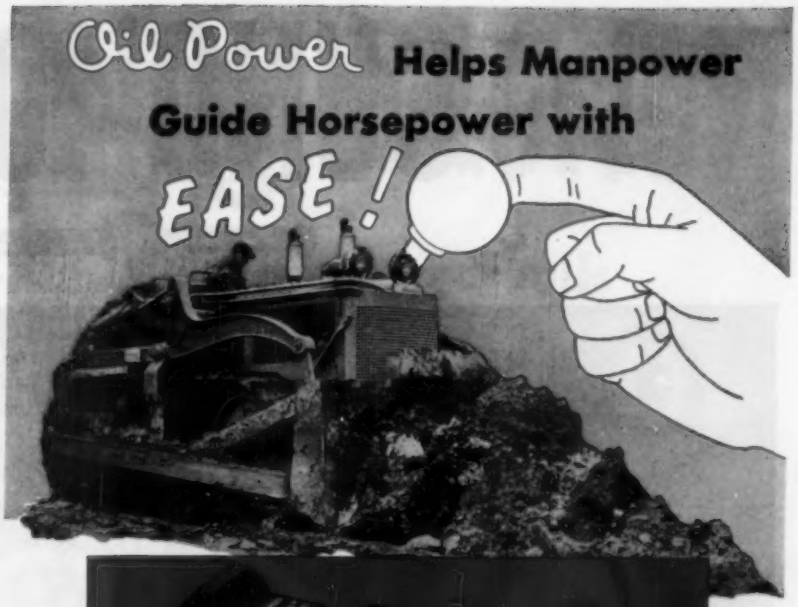
Three other major technical organizations will act as co-sponsors with the Society: The Armour Research Foundation of Illinois Institute of Technology, The National Fluid Power Association and The National Tool and Die Manufacturers Association. ▼▼▼

Numerically Controlled Turret Lathe

Completely controlled by a punched tape, this machine, made by Jones and Lamson, is automatically cycled and provides rectilinear motions with precise con-

trols to the end points. In addition to these commands the tape also controls spindle speed, operation of hydraulic powered chuck and bar feed, indexing of the six position turret, turning coolant on or off, resetting the tape to repeat cycle, and other operations. ▼▼▼

Continued on page 28



Arm-weary tractor operators are grateful for TD-14A and TD-18A International Harvester crawlers. They steer with the ease of a late model car for each track is controlled by its own hydraulic circuit...a booster system with velvet smooth, positive action that stems from

HYDRECO
Oil Power

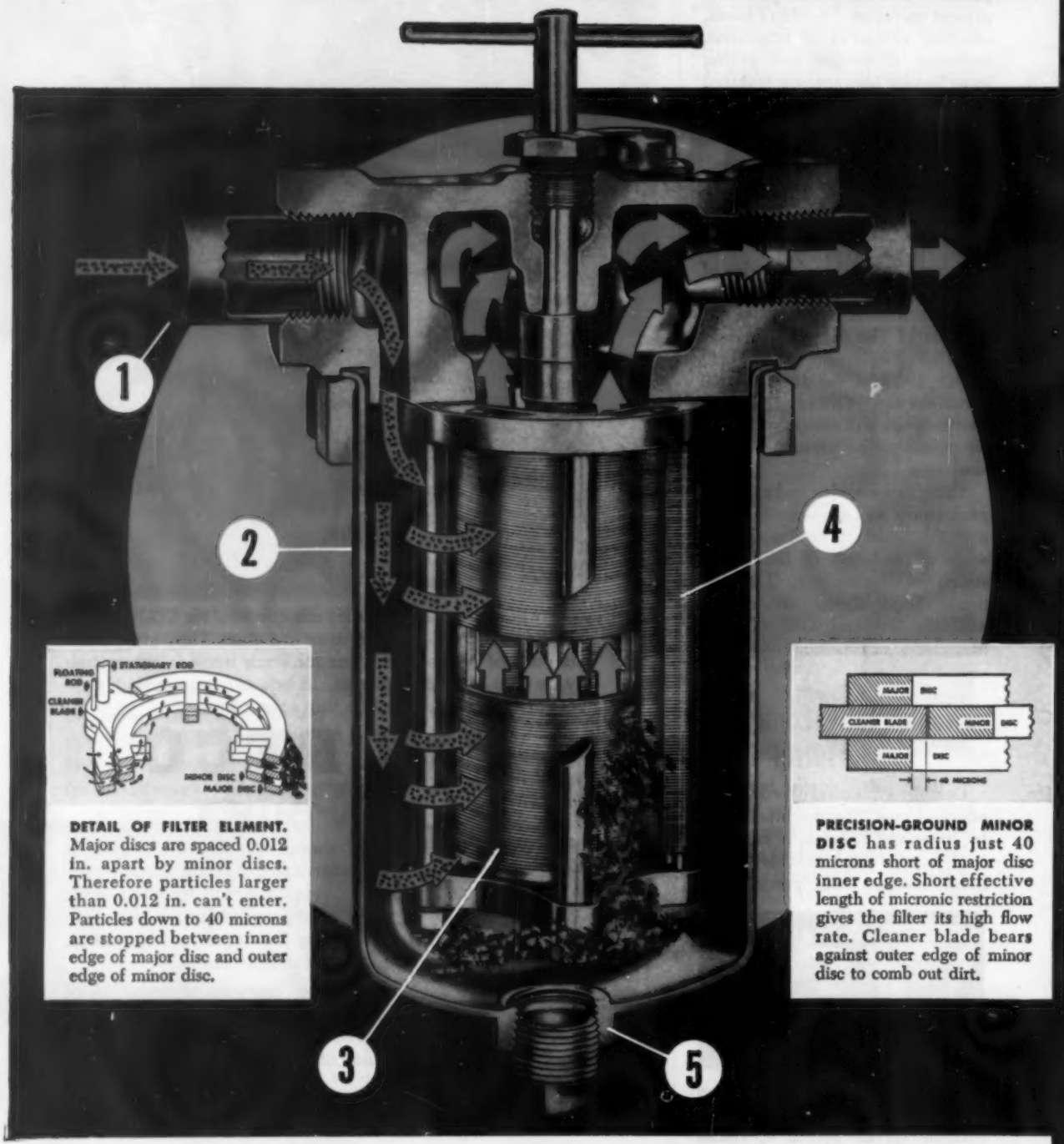
Here is a HYDRECO dual pump that delivers 5 gpm to each circuit at 1200 rpm against a system pressure of 700 psi. The dual pump provides a circuit for each track and the result . . . no arm-weary operators . . . more accomplished with less effort, in less time . . . smoother, higher performance . . . lower maintenance.

For engineers seeking practical answers to problems of trouble-free hydraulic controls, better performance, added functions and greater sales appeal for mobile equipment, the experience of HYDRECO engineers offers a definite answer!

WRITE— *for latest literature and full information on new developments in HYDRECO Pumps, Motors, Valves, and Cylinders.*

HYDRECO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1104 EAST 222nd STREET • CLEVELAND 17 • OHIO
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

New! CUNO 40-micron



DETAIL OF FILTER ELEMENT. Major discs are spaced 0.012 in. apart by minor discs. Therefore particles larger than 0.012 in. can't enter. Particles down to 40 microns are stopped between inner edge of major disc and outer edge of minor disc.

PRECISION-GROUND MINOR DISC has radius just 40 microns short of major disc inner edge. Short effective length of micronic restriction gives the filter its high flow rate. Cleaner blade bears against outer edge of minor disc to comb out dirt.

CUTAWAY of new SUPER Auto-Klean. Dirty liquid enters inlet (1) at left, fills housing (2) and flows through metal-edge filter (3) of stacked major and minor discs. Trapped dirt is combed out by cleaner blades (4) when discs are rotated and is removed through drain (5). Clean liquid rises through center of filter element, leaves at right.

self-cleaning filter!

The SUPER Auto-Klean for lube, hydraulic fluid, coolant, fuel and other liquids

. . . and you can clean this filter by simply turning the handle!

Many times smaller than other micronic filters of equal capacity, Cuno's new SUPER Auto-Klean filter now makes possible economical, compact, micronic filtration at high flow rates and eliminates the need for replacement cartridges. On machine tools and industrial machinery, SUPER Auto-Klean gives micronic filtration of lubricating oil, hydraulic fluids, coolants, fuels and other liquids. Here's what it offers:

1. Full-flow micronic filtering with a self-cleaning filter. Filter can be cleaned continuously with motor drive or intermittently by manually turning handle.

2. Eliminates cartridge changes. Ends operating costs if you've been using cartridge filters.

3. No pressure drop build-up. An 8-in. long, 2¾-in. diameter cartridge handles 30 gpm of oil of 200 SSU viscosity with only 3 psi pressure drop—up to 75% more with slightly higher pressure drop.

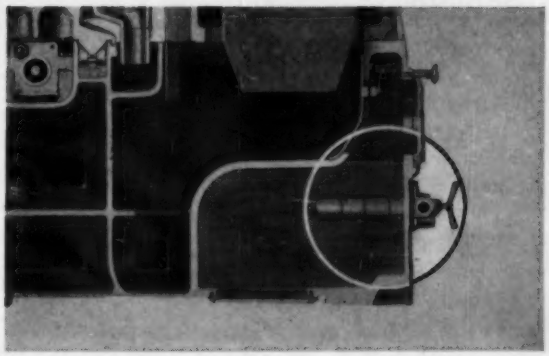
4. Positive protection against particles larger than 40 microns (actually 0.0015 in.). Filter can't rupture or channel.

5. Much smaller than replaceable-cartridge-type filters of equal capacity. It saves with lower initial costs, lower installation costs, requires less space than cartridge units. You get high capacity in a small package.

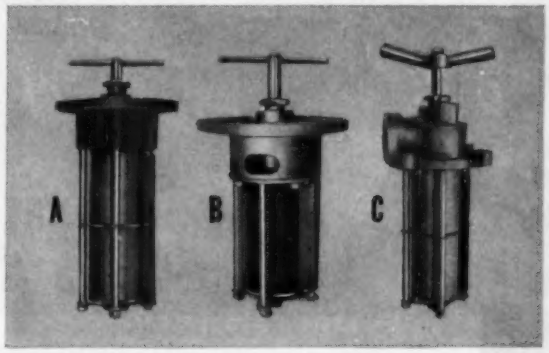
6. No duplex units needed. Handles full flow all the time with no interruptions for cleaning.

7. SUPER Auto-Klean fits existing Auto-Klean housings. You can easily replace most 2¾-in. diameter cartridges with SUPER Auto-Klean for finer filtration.

Send coupon for complete information on the new SUPER Auto-Klean filter, for your new designs or existing equipment. Cuno Engineering Corporation, 20-11 South Vine Street, Meriden, Conn. 5.6



WILL IT FIT? Here's how one designer answered that question. Filter *(circled)* mounts horizontally in side wall of hydraulic fluid reservoir in this surface grinder.



FILTERS FOR INTERNAL PIPING *(A and B above)* allow streamlined design plus the best in filtration. Flange mounting with external outlet *(C above)* and line-type *(cutaway on facing page)* are just two of many other possibilities.

MAIL COUPON FOR COMPLETE INFORMATION

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids from More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)

CUNO ENGINEERING CORPORATION
Department 20-11
2-11 South Vine Street, Meriden, Conn.

Please send me full data on the NEW Cuno SUPER Auto-Klean filter.

Name_____

Firm_____

Position_____

Address_____

City_____ Zone_____ State_____

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a complete standard line to economically meet your needs
You can save with Page Leather Packings and here's why: They are made of various leathers with treatments or impregnations to best do the specific job at hand. They are tough, pliable, highly resistant to abrasion and wear, so you can depend on them for long life and service.
Page's complete line includes Standard Synthetic Packings . . . U's, V's, Cups, Flanges and O-Rings for various applications and pressures.
And what's more, with Page you not only get well-made packings, but you also get the services and cooperation of qualified packing engineers backed up by a company with 87 years of packing experience and know-how. When you come to Page for packings we can often help you cut basic manufacturing costs as well as packing costs.
Write for Page Packing Catalog today . . . or send us your requirements. Specify Page Packings and you'll save.
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PAGE BELTING CO.
TRADE MARK
It will pay you to specify
PAGE PACKINGS
Engineered to do a better job

BRIEFS continued

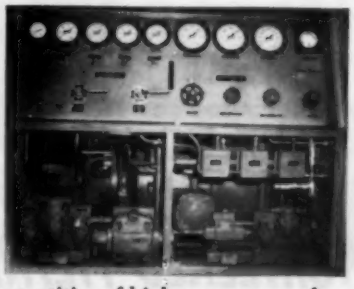
Carter Achievement Award Presentation

An inscribed gold medal and a five-hundred dollar cash award were presented to Karl Schubert, design engineer at National Acme Company, at a recent dinner held in Cleveland. Schubert was awarded first prize for his paper "Vertical Automatic Multiple-Spindle Chucking Machine" in a pneumatic and hydraulic design competition sponsored by Carter Controls, Inc., Lansing, Illinois.

J. Carter Miller, president, Carter Controls, Inc., presents the award to Karl Schubert. Paul L. Reed, executive editor, APPLIED HYDRAULICS Magazine, looks on. ▼▼▼

Hydraulic Helium Booster Compressor Assists Guided Missile Program

Utilizing several stages of compression within a pump, this compressor has been designed to meet the increasing need for larger



quantities of high pressure gas free from oil or other contamination for servicing missiles and for tests related to their development.

This multiple stage hydraulic booster—which retains much of

Continued on page 32

How Correct Lubrication cured it—saved over $8,000 a year!

It was almost as if some superhuman hand were holding it back, preventing the massive 5-ton table from moving smoothly on its ways—causing it first to stick and then jump forward erratically.

This trouble happened in a plant using a huge hydraulic surface grinder for rough and precise finishing of parts for home power saws. To obtain precise finishes, table speed had to be reduced; but whenever this was done the table jumped, resulting in poor finish and excessive rejects. To overcome table jumping, the operators *tripled* hydraulic pressure in the machine. This caused failure of tubing and fittings, increased wear, shut down the grinder an average of 10 hours a week!

A Socony Mobil man discovered this trouble while providing engineering service to this plant. After studying the grinder, he recommended using a special Gargoyle oil for table way lubrication. This cured the table sticking and jumping. Hydraulic pressure was reduced to normal. The plant is now saving $8,000 a year on production alone—has cut maintenance costs drastically!

★ ★ ★

A program of Correct Lubrication entitles you to this same kind of lubrication engineering service. Use it in *your* plant to improve production—cut costs!

SOCONY MOBIL *Correct Lubrication*

FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.
Formerly Socony-Vacuum Oil Company, Inc.

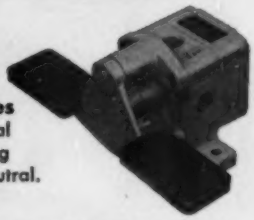
Ledeen

PNEUMATIC AND HYDRAULIC EQUIPMENT

VALVES
bulletin 1010

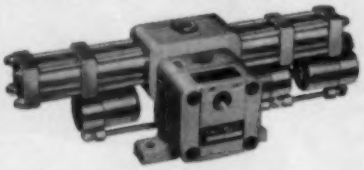
Hand Valves Manual or spring return to neutral or to reverse.

Foot Valves Single pedal spring return to reverse.

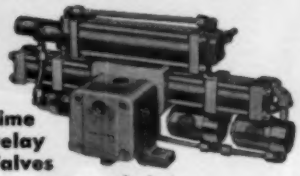


Foot Valves Double pedal foot or spring return to neutral.

Power Valves Two position, forward and reverse.

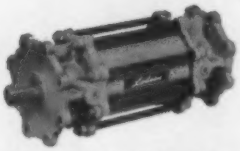


Power Valves Three position, forward, neutral and reverse.

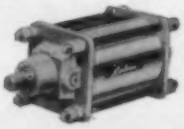


Time Delay Valves Power operated closing after delay interval.

CYLINDERS
bulletin 500



Heavy Duty Cylinders



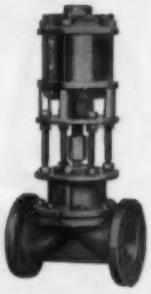
Medium Duty Cylinders

Boosters

Special Cylinders

VALVE ACTUATORS
bulletin 3030

Gate Valve Actuators



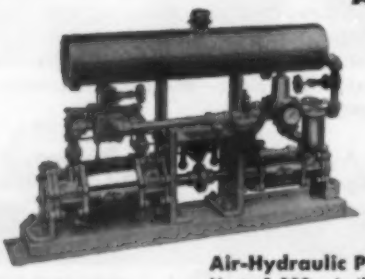
Diaphragm Valve Actuators

bulletin 3020

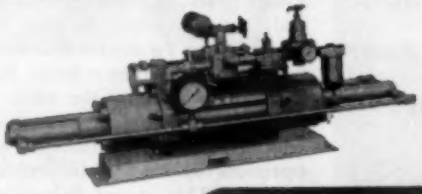
Plug Valve Actuators

Plug Valve Actuators

AIR HYDRAULIC PUMPS *bulletin 4000*



Air-Hydraulic Pumps Up to 1,000 psi oil from 100 psi air or gas.



Air-Hydraulic Pumps Up to 10,000 psi oil from 100 psi air or gas.

Ledeen Mfg. Co.
1610 So. San Pedro St.
Los Angeles 15, Cal.

Top quality—prompt delivery

'VSG'

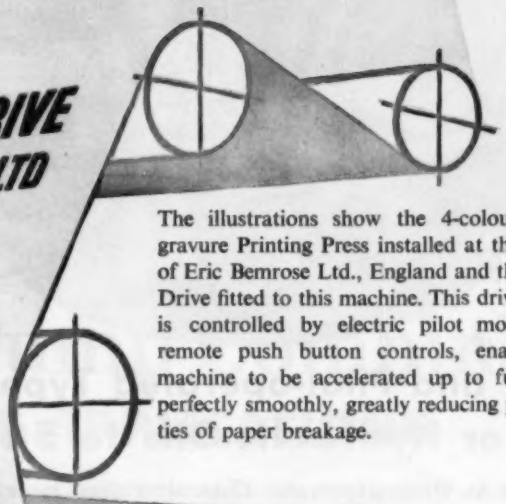
Regd Trade Mark

SERVING MODERN INDUSTRY

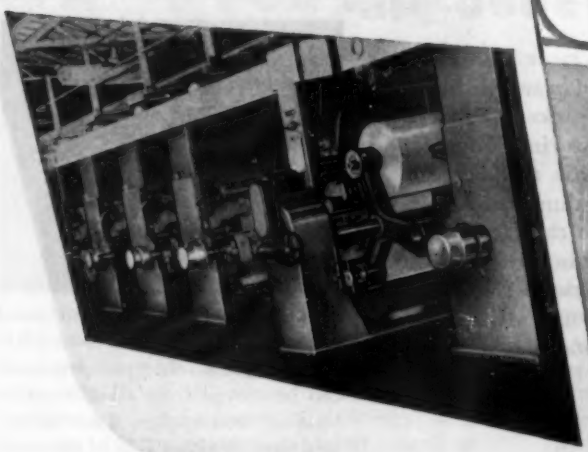
Infinitely VARIABLE SPEED GEARS

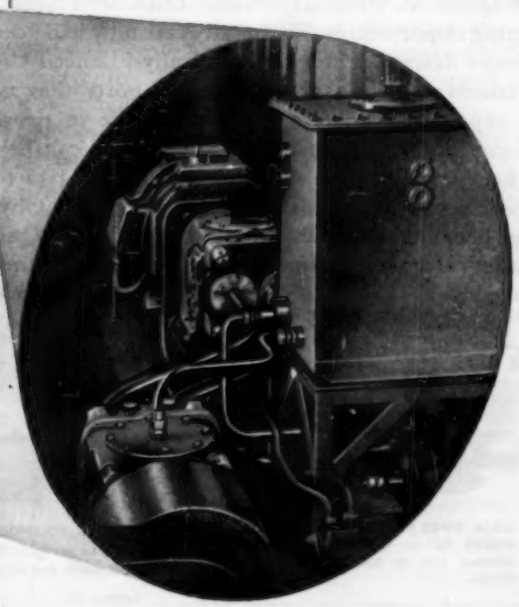
PRINTING PRESS DRIVE
at the works of ERIC BEMROSE LTD

- *High Starting Torque*
- *Smooth Acceleration*
- *Remote Push Button Control*



The illustrations show the 4-colour Rotogravure Printing Press installed at the Works of Eric Bemrose Ltd., England and the 'VSG' Drive fitted to this machine. This drive, which is controlled by electric pilot motor with remote push button controls, enables the machine to be accelerated up to full speed perfectly smoothly, greatly reducing possibilities of paper breakage.





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WEST: Galbraith & Sulley Ltd., 1331 West 6th Avenue, Vancouver, 9

Quick-As-Wink® Hydraulic Valves

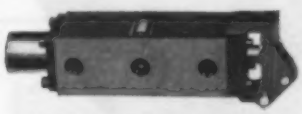
Lever Operated 3-position 4-way Hydraulic Valve

Double Pilot Cylinder Operated 3-position 4-way Hydraulic Valve

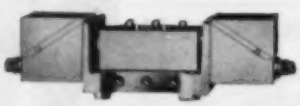
Hand and Pilot-operated Types for Water or Hydraulic Oils to 5000 psi.

• Quick-As-Wink Hydraulic Control Valves meet the most exacting requirements. These valves are fully balanced in any position. Patented design includes hydraulically balanced U-packers. Packers are floated while crossing the valving ports, thus assuring long life, and expanded by internal valve pressure to provide a tight seal. Maintenance is extremely low and usually can be done quickly in the field, avoiding the delay of returning valves to the factory for servicing, or the need of maintaining large standby inventories. For long, dependable, trouble-free service, specify Quick-As-Wink Hydraulic Valves. Write for Bulletin No. 531 and the fully descriptive Data Sheets. They give complete details. Write *today!*

Ask us also about . . .



CAM OPERATED SINGLE PLUNGER VALVE 3/16" to 3/8" sizes. Operated by rotating cam or lond on reciprocating device.



DOUBLE SOLENOID "O-TYPE" VALVE for pressures up to 125 psi. Widely used as pilot valves and for operating air cylinders.

Quick-As-Wink® AIR AND HYDRAULIC Control Valves

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1998 East Pershing St., Salem, Ohio

BRIEFS continued

the simplicity and compactness of the single stage booster—has the advantage that the gas obtained from commercial bottles at pressures of 2000 psi can be repressurized efficiently to desired higher pressures within one compressor.

The compressor, designed by Haskel Engineering and Supply Company, incorporates the principle of a double acting hydraulic booster to multiple stages so arranged as to be self regulating for maximum output at any inlet pressure between minimum and maximum available. ▼▼▼

Hydraulic Press Has Movable Pressing Head

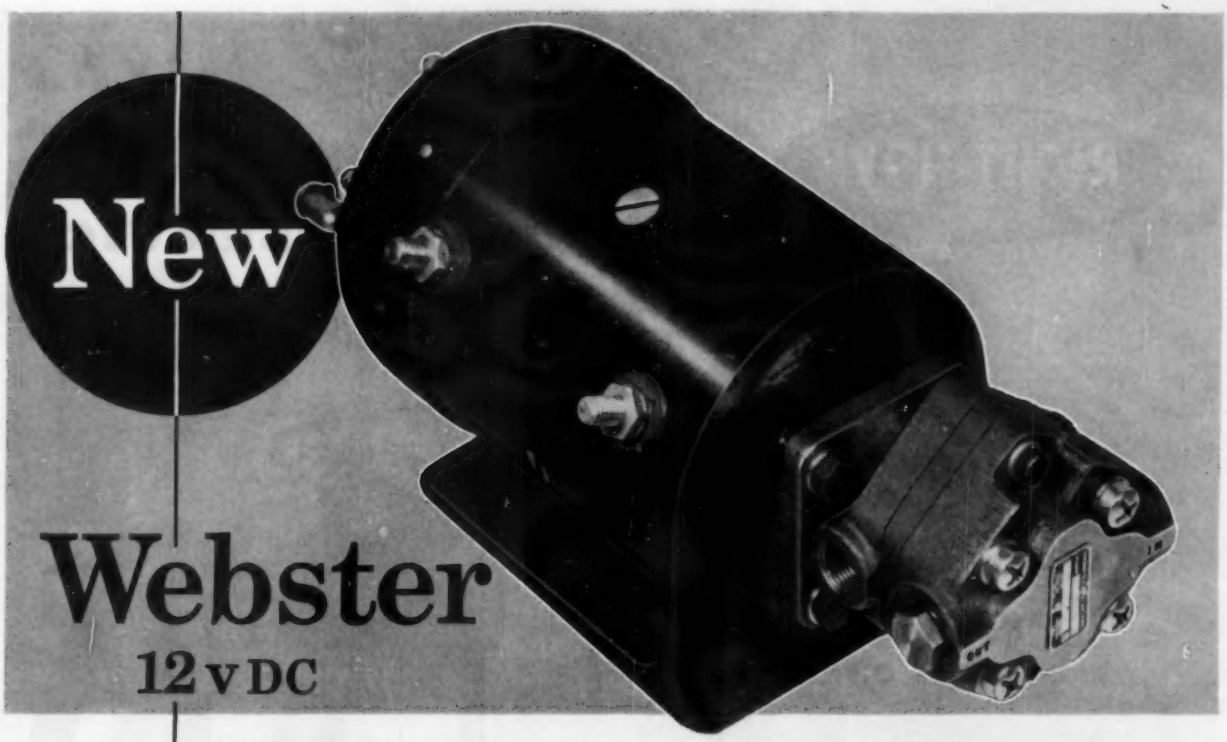
Principally used for straightening armor plate, this press, designed and engineered by the Clearing Machine Corporation for the Lukens Steel Company, has a capacity of 5000 tons pressure. The press is electrically controlled

by one man from a control panel and derives its pressure from a hydraulic system. The pressing head can be moved from right to left a total of 160 inches. Two motorized cars on either side of the press can shift the steel plate backward or forward, permitting any area of the plate to be flattened. Incorporated in the bed of the press are 32 lifting pins for raising or lowering the length of plate. ▼▼▼

Can YOU Help?

To provide needed information to army ordnance and arsenal personnel and to the engineering staffs of contractors having ordnance design responsibilities, the Army Ordnance Corps has initi-

Continued on page 36



Motor Pump Combination
FOR MOBILE APPLICATIONS

for All Battery-operated Vehicles, Lift Trucks, Snow Plows, Tail Gate Lifts, Graders

• Here's WEBSTER's brand new motor-pump combination for all 12 volt battery-operated applications. It is furnished in a range of capacities up to 2½ gpm at 1000 PSI, with permissible pressures up to 3000 PSI.

This new unit carries a very reasonable price tag. And it incorporates the quality construction features and advanced engineering you've learned to expect from WEBSTER. For example:

Compact, Easy Mounting · The entire combination measures only 12⅜" in length. The clean, compact design includes a 4-bolt foot mounting integral with the motor for ease of installation in crowded locations.

Direct Coupled · Direct coupling eliminates alignment problems between pump and motor, does away with any need for external flexible couplings. The hydraulic power source can be readily installed near the power requirements, substantially shortening the length of hydraulic circuits—thus minimizing danger of leaks and reducing maintenance.

Adaptable · Pumps with greater or smaller capacities can be substituted without changing the mounting. Parts are standardized and interchangeable for greatest flexibility. Built-in relief valves and check valves can be provided if desired.

Nylon Valves—a Webster Exclusive · Nylon check and relief valves, exclusive with WEBSTER, for leakproof operation and longer life. Nylon plungers provide tight seal even if minute particles of foreign matter are caught between plunger and seat.

Special Motor Construction · Specially constructed heavy duty DC series motor gives high starting torque—can be supplied with stationary or removable brushes.

Write Today

FOR COMPLETE INFORMATION

☐ Please send us performance data on new 12 v DC Motor Pump Combination

☐ Please send catalog on complete WEBSTER line

Name_____

Title_____

Company_____

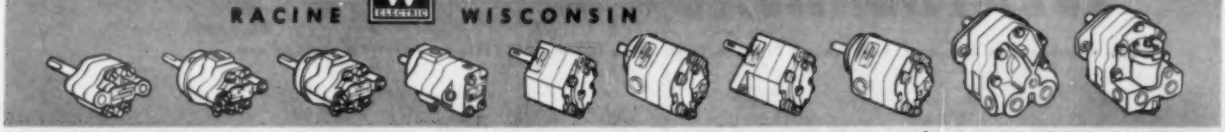
Street_____

City, Zone & State_____

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

RACINE WISCONSIN



MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS FROM 1/5 TO 30 GPM CAPACITY

RIGHT-NOW SWAGED HOSE ASSEMBLY SERVICE

AT YOUR WEATHERHEAD DISTRIBUTOR

Any hose assembly made in 3 minutes

RIGHT IN HIS OWN SERVICE SHOP!

Now, for the first time, your Weatherhead distributor offers you complete swaged hose assembly service right in his own shop. No waiting for shipments of factory-finished hose assemblies. No need for costly downtime and delay. Equipped with the new Weatherhead swaging press and the complete line of Weatherhead hose and hose ends, your distributor is prepared to supply you with any size, type and length hose assembly at once.

Wherever you are, whatever your need, there is a Weatherhead distributor strategically located to give you immediate stand-by swaged hose assembly service.

WEATHERHEAD

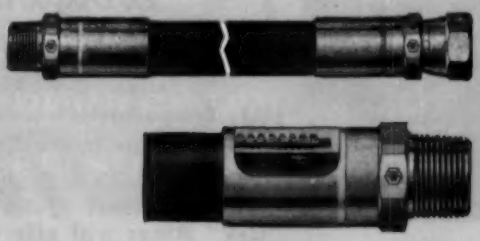
The Weatherhead Company, Fort Wayne Division, Dept. A-11, 128 West Washington, Fort Wayne, Indiana

Now available at

WEATHERHEAD DISTRIBUTORS

WEATHERHEAD—Your Only Complete Single-Source Hydraulic Hose and Fitting Line. Any industrial hose for any need—low, medium-high and high-pressure applications; available in complete size ranges to 2" I.D.; suited for any service condition.

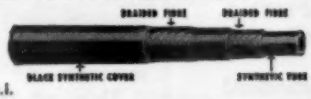
Weatherhead swaged hose assemblies match factory-made assemblies in every respect. They're available in any quantity, length, type or size to meet your needs and at no additional cost to you. Take advantage of your local Weatherhead distributor's dependable RIGHT-NOW swaged hose assembly service. Another Weatherhead first . . . component parts for hydraulic hose lines.



TYPES OF HOSE

H-17 TWO FIBRE BRAID • MEDIUM PRESSURE

sizes: ¼" to 1" I.D.
working pressures: 550 to 1250 p.s.i.



H-104 ONE WIRE BRAID • MEDIUM PRESSURE

sizes: ¼" to 1" I.D.
working pressures: 1250 to 2500 p.s.i.

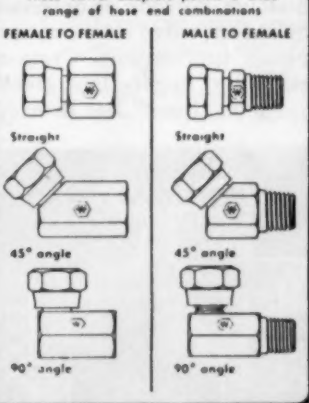
H-425 TWO WIRE BRAID • HIGH PRESSURE

sizes: ¼" to 2" I.D.
working pressures: 1250 to 4500 p.s.i.

TYPES OF HOSE ENDS

SWIVEL ADAPTERS

These swivel adapters permit a wide range of hose end combinations



WEATHERHEAD LEADS THE WAY

Send for full details TODAY!

The Weatherhead Co., Fort Wayne Division
128 West Washington, Fort Wayne, Indiana

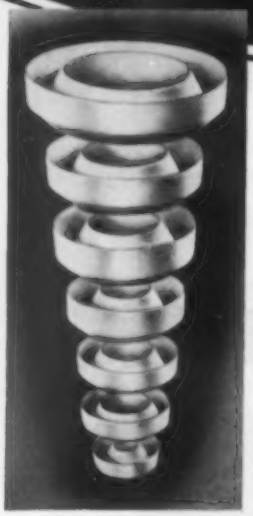
Send full details on your Distributor's Stand-by Swaged Hose Assembly Service.

Company _____

Address _____

Your Name _____

"JOHN CRANE"
TEFLON*
"C-V" rings

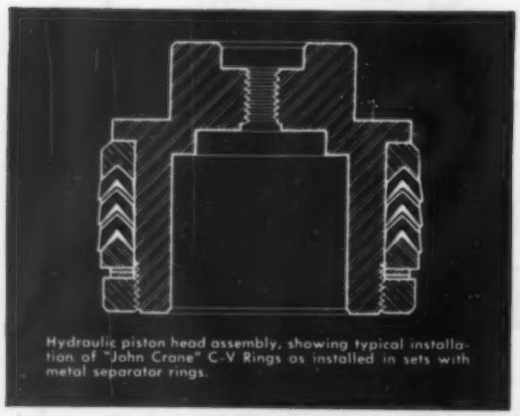


First preference
in hydraulic service
everywhere!
because...

Teflon "C-V" Rings withstand
1. Temperature from —94° to +482°F.
2. Any type hydraulic fluid

Why repack with ordinary materials when corrosively inert "John Crane" Teflon "C-V" Rings will effectively seal any hydraulic fluid, including the newly developed synthetics, and resist high temperatures as well. Also, they have extremely low friction characteristics—will not shrink, swell, harden, dissolve, corrode or deteriorate. Ideal for use on hydraulic cylinders, valve stems, reciprocating, centrifugal and rotary pump applications. Cross-section design allows effective sealing at finger-tight gland pressure.

"John Crane" has developed a complete line of standard size Teflon "C-V" Rings and male and female adapter rings to meet practically every need. If you have special requirements, "John Crane" can mold additional sizes to fit your stuffing box requirements.



Hydraulic piston head assembly, showing typical installation of "John Crane" C-V Rings as installed in sets with metal separator rings.

Send for complete information, including this illustrated technical booklet, "The Best in Teflon."
Crane Packing Co., 1805 Cuyler Ave., Chicago 13, Ill.
In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.

*Du Pont trademark

JOHN CRANE
CRANE PACKING COMPANY

BRIEFS continued

ated the preparation of a comprehensive Ordnance Engineering Design Handbook, to summarize fundamental principles and basic design data.

It is important that uncertainties as to the meaning of terminology and nomenclature do not impede ordnance design and development and to establish definitions for many ordnance terms which are also used in other areas of science and technology.

If you have either formal or informal collection of terminologies, glossaries, specialized dictionaries or references, please contact: Allen Kent, Associate Director, Center for Documentation and Communication Research, School of Library Science, Western University, Cleveland 6, Ohio. ▼▼▼

Defreezing Compressed Air Lines

The freezing of condensate in the lower parts of air lines during winter time has frequently been a cause of erratic equipment performance. Radford Electronics Ltd., England, has produced a defroster which will thaw the lines in a few moments.

This unit is essentially a 2 kw transformer running off any electric power source. Two cables from its secondary are put in contact on either side of the frozen pipe. The defroster will melt the ice plugs in a ½ inch pipe at the rate of 9 feet per minute. The unit is compact, provided with carrying handles, and due to the low voltage completely safe to use. ▼▼▼

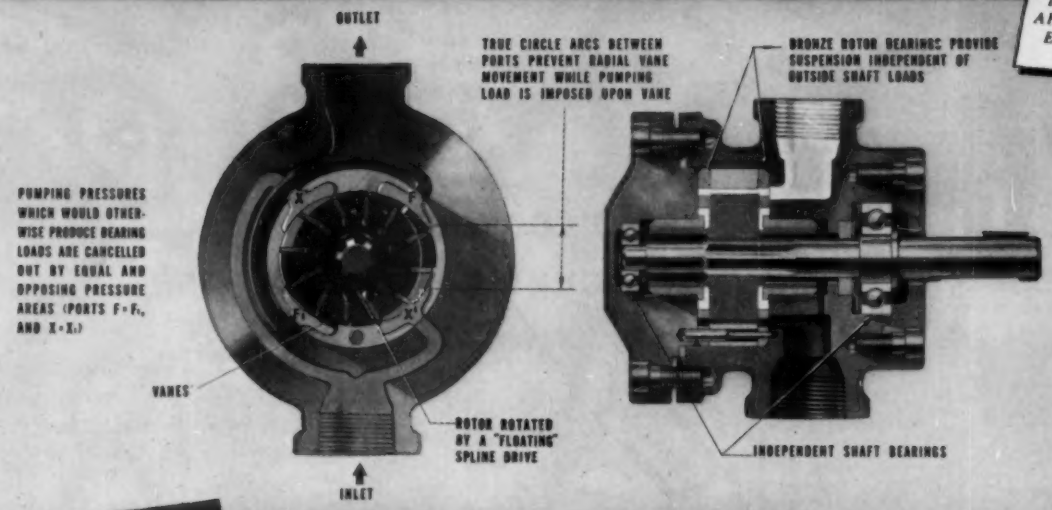
Hydraulics Assists Cable Reel Truck

This new "walkie" electric truck has been designed by Lewis-Shepard Products, Inc., to handle cable reels weighing up to 10,000 pounds and a full range of diameters from 36 inches to 90 inches. The truck, easy to maneuver, op-

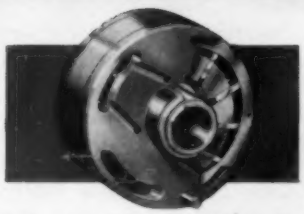
Continued on page 38

Question: Why are VICKERS Balanced Vane Type Pumps the most widely used oil hydraulic power pumps?

HUNDREDS OF THOUSANDS ARE RUNNING EVERY DAY


OUTLET
TRUE CIRCLE ARCS BETWEEN PORTS PREVENT RADIAL VANE MOVEMENT WHILE PUMPING LOAD IS IMPOSED UPON VANE
BRONZE ROTOR BEARINGS PROVIDE SUSPENSION INDEPENDENT OF OUTSIDE SHAFT LOADS
PUMPING PRESSURES WHICH WOULD OTHERWISE PRODUCE BEARING LOADS ARE CANCELLED OUT BY EQUAL AND OPPOSING PRESSURE AREAS (PORTS F-F1 AND X-X1)
VANES
ROTOR ROTATED BY A "FLOATING" SPLINE DRIVE
INDEPENDENT SHAFT BEARINGS
INLET

Answer: Because of their SUPERIOR PERFORMANCE and MANY OTHER BENEFITS for the user.



For more than two decades, the Vickers Balanced Vane Type has held the leading position among hydraulic power pumps . . . growing steadily in popularity. The various models (see below) are *the most widely used of all pumps in oil hydraulic service.*

Above is the pumping cartridge which is one of this pump's distinctive features. The many advantages listed at the right merit the thoughtful attention of anyone concerned with the selection and use of oil hydraulic pumps.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

1474 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices • ATLANTA • CHICAGO AREA (Brookfield) • CINCINNATI • CLEVELAND DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N. J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA WASHINGTON • WORCESTER

IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

COMPLETE HYDRAULIC BALANCE—Each inlet and outlet port is balanced by another equal in size and radially opposite . . . pressure-induced bearing loads are thus eliminated. Pressure-balanced porting plates maintain ideal running clearances.

FLOATING SPLINE DRIVE—Rotor is driven by a "floating" spline. Rotor and shaft have separate bearings . . . avoiding strain from drive misalignment.

TRUE-CIRCLE CAM ARCS between ports prevent radial vane movement while pumping load is imposed upon vanes. Wear between vanes and rotor is thus practically eliminated.

ABILITY TO TOLERATE DIRT—Clean oil is of great importance in a hydraulic circuit; but, in spite of care, dirt sometimes gets in. The Vickers Vane Type Pump will pass a reasonable amount of dirt without trouble and without grinding it up.

REPLACEABLE CARTRIDGE—Cartridge (illustrated above left) contains all pumping parts that move . . . none contact the housing. Working parts can be removed and inspected without disconnecting piping or drive coupling. Replacement cartridge kits are available and pumps need not be sent to the factory for repairs. Pump capacity can be changed by simply changing cartridge in the field.

HIGHER EFFICIENCY—Tests prove exceptionally high volumetric and overall efficiency . . . not only when pump is new but also after long service.

AUTOMATIC WEAR COMPENSATION—Vanes are held in contact with the cam ring by centrifugal force and hydraulic pressure. If wear occurs, vanes revolve in a slightly larger orbit without appreciable change in performance.

MINIMUM MAINTENANCE—Hydraulic balance . . . floating spline drive . . . independent bearings . . . automatic wear compensation eliminate the most important causes for maintenance and repair.

TEMPERATURE ADAPTABILITY—Correct running clearances are automatically maintained which compensate for wide variation in oil viscosity resulting from temperature variation.

LONGER LIFE—The numerous features mentioned above that keep down maintenance also contribute to longer life. Then, a new cartridge completely rejuvenates the pump.

CONSTRUCTION SIMPLICITY is evident from the illustrations above. This simplicity is another reason for the superiority of Vickers Vane Pumps. For further information, ask for Bulletin 5002A.

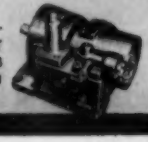
7182

ALL MODELS HAVE THE VICKERS ADVANTAGES MENTIONED ABOVE

Single Stage. Pressures to 1,000 psi. Capacities to 55 gpm.

Two Stage. Pressures to 2,000 psi. Capacities to 55 gpm.

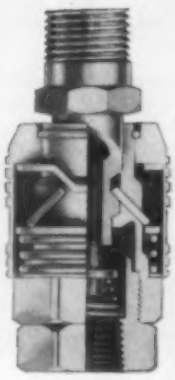
Double Pump—Two pumps for separate circuits driven by common shaft.



Two-Pressure Pump automatically delivers larger volume at low pressure and smaller volume at high pressure.

NEW "HI-LO" SPEED COUPLERS and CONNECTORS

(HIGH VOLUME — LOW PRESSURE DROP)



"HI-LO" for *highest* air volume, *lowest* pressure drop

Better efficiency, lower operating costs for all air-operated devices.

Easy to use—snap on and off.

Swivel action saves wear on hose.

Wide selection of sizes for greater range of uses.

Leak-proof seal.

Interchangeable with many other brands of couplers and connectors.

Write for bulletin No. 5518T.

THE ARO EQUIPMENT CORPORATION
Bryan and Cleveland, Ohio

Aro Equipment of California, Los Angeles, Calif., Aro Equipment of Canada, Ltd., Toronto 15, Ontario.

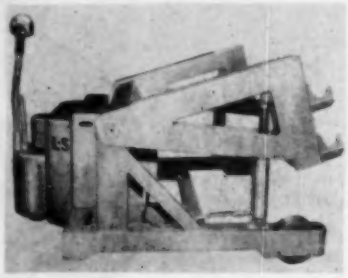
Offices in All Principal Cities

ARO ®
SPEED COUPLERS
Also Air Tools . . . Air Hoists . . . Lubricating Equipment . . . Aircraft Products . . . Grease Fittings

BRIEFS continued

erates with the handle in any position.

Twin hydraulic cylinders, one attached to each lifting arm, are



synchronized so that they lift together. Lifting and lowering controls, as well as brake, traction and direction are located in the handle head. ▼▼▼

Recent Publications

The Hydraulic Institute, New York, has published a new edition of the Pipe Friction Manual. Paper bound, 87 pages. Price $1.75 Domestic, $1.85 Foreign.

Data contained in this edition is based on latest available information and is an extension and rearrangement of material used in an earlier publication entitled "Tentative Standards of the Hydraulic Institute—Pipe Friction".

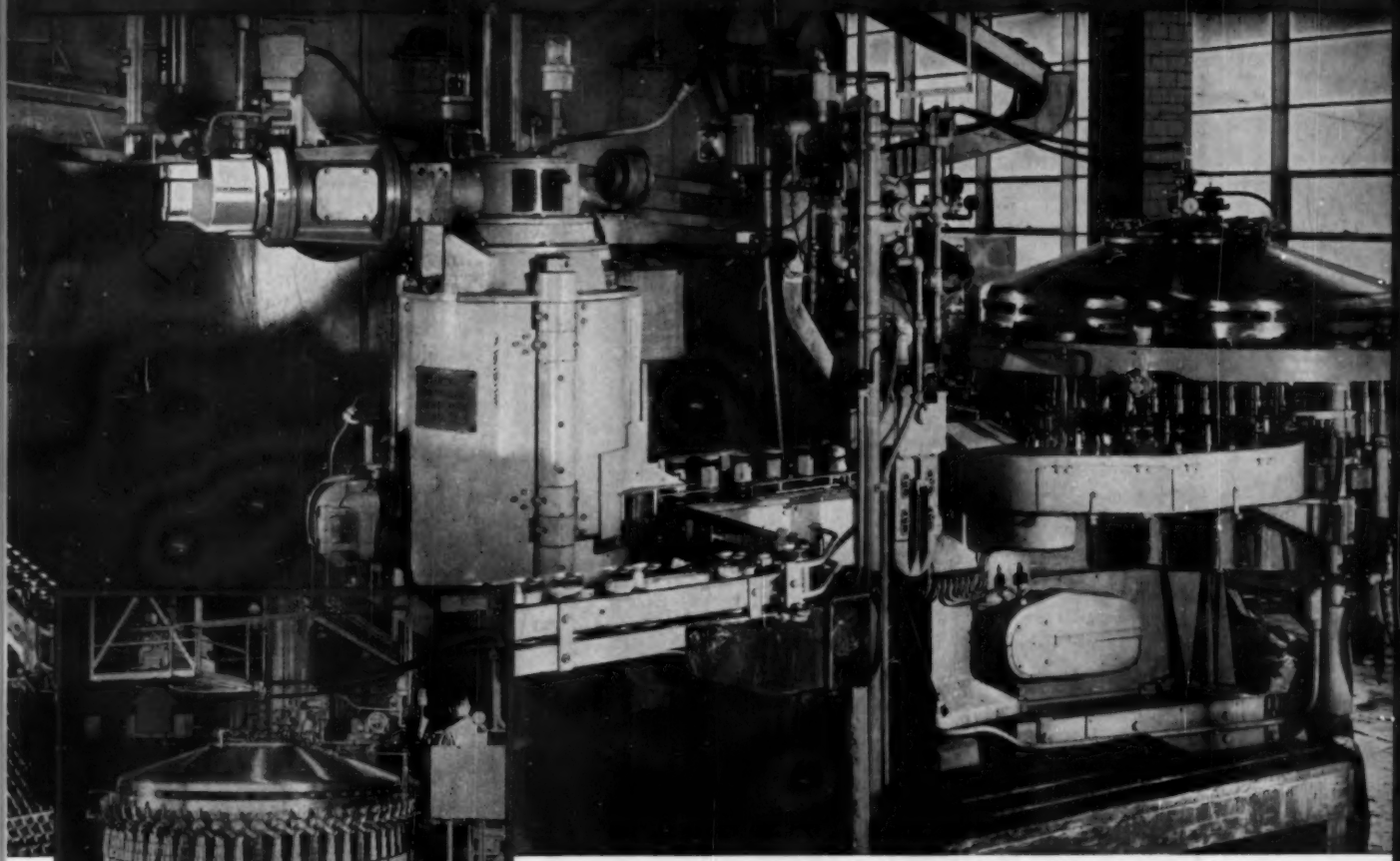
Examples show actual mathematical solutions to pipe friction problems. Complete tables of friction loss for water in feet per 100 feet of pipe are given. Tables of resistance coefficients for valves and fittings present the latest experimental data. Also included are charts of friction factors with related data to permit calculation of the friction loss for any fluid.

This edition, which includes a full list of the references showing sources of the data, is a most complete treatise on the subject.

The British Institution of Production Engineers has published the proceedings of the Conference "The Automatic Factory—What Does It Mean?". The volume contains all the speeches and papers given and includes reports on the group discussions of the various

Continued on page 40

You too can discover
THE WAY UP IS OILGEAR



Beer Can Filling and Closing Machines equipped with Oilgear "ANY-SPEED" Drives are operating in many breweries. With Oilgear, beer can filling and closing production climbed from 360 to 600 cans a minute.

OILGEAR
Fluid Power

PIONEERS...NOW THREE PLANTS FOR FLUID POWER

PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS & VALVES

"ANY-SPEED" DRIVES BOOST FILLING-CLOSING RATE TO 600 BEER CANS PER MINUTE. SIMPLIFY MACHINE DESIGN TOO.

There is a necessity upon every machine designer to improve the performance of his machines—if he can. When the designers of beer-can filling and closing machines raised the rate from 150 to 360 cans per minute, the drive limit seemed to be reached. Yet, their users wanted more production *without spillage* or can conveyor problems.

Then these engineers tried Oilgear "ANY-SPEED" Drives... the Fluid Power and Control that gave them what they wanted and—even more.

These engineers stipulated: • accelerate machines to half speed in 2 seconds • accelerate machines to full speed in 5 seconds • decelerate and stop machines in 4/10 seconds • a filling-closing rate of 425 cans per minute.

The Oilgear drive accelerated and decelerated so smoothly, it actually provided: • acceleration to full speed in 2 seconds • deceleration and stop in 2/10 seconds • a filling-closing rate of 600 cans per minute.

That's not all. Oilgear's cushioned application of power plus inherent positive protection against high overload starting torques and lower overload running torques eliminated the need of mechanical slip clutches. Thus, the machine design is simplified and maintenance is negligible.

This smooth yet swift acceleration and deceleration that allows brewers to handle full cans without spilling is one of two tremendously important Oilgear advantages. Utterly variable, flexible and controllable speed is the other. These and other superiorities are writing new history in machine design. *You ought to know the details of that history.* Why don't you contact a nearby Oilgear engineer, or write to Milwaukee. No cost, but the profits may be great.

THE OILGEAR COMPANY
1564 W. Pierce Street
Milwaukee 4, Wisconsin

Circle 100 on Reader Service Card

Tannate® packings . . .

do a real job for nationally known alloy metal producer

Problem: A Nationally known Alloy Metal producer was not satisfied with their general maintenance packing performance. Lack of engineering service, inadequate performance and the fact that previous packings used required additional lubrication accounted for many packing problems.

Solution: Rhoads Sales Engineer suggested the use of Rhoads Packing Data Sheets for complete packing specifications and to assure correct packing construction. He also made helpful suggestions for the installation and maintenance of Rhoads leather packings in this company's many hydraulic and pneumatic installations.

Results: Through the use of Rhoads Tannate Leather Packings, proper sealing and longer life was obtained; down time was cut and delivery was expedited for their emergency requirements.

RHOADS
INDUSTRIAL LEATHERS

WILMINGTON • NEW YORK • CHICAGO • ATLANTA

BRIEFS continued

papers presented. New techniques, new mechanisms, sociological aspects of automation, educational and management aspects are the main themes covered.

The book is available from The Publications Department, The Institution of Production Engineers, 10 Chesterfield Street, London W.1., England, Approx. American Price: $4.

"Progress Through Invention" is the title of a 28-page booklet which contains reprints of talks given at the first Invention Exhibit and Conference held at the Cleveland Engineering Society earlier this year. Six authorities present various phases of the need for inventions, how to invent, how to patent your ideas and how to sell them. This booklet may be obtained from The Cleveland Engineering Society, 2136 East 19th St. Cleveland 15, Ohio. Price $1.

▼▼▼

FUTURE EVENTS

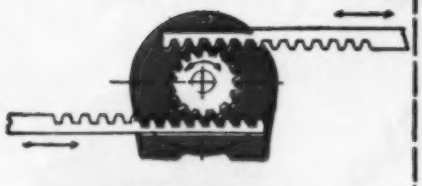
November 2-3: Fifth Transport Aircraft Hydraulic Conference, Park Sheraton Hotel, Detroit, Michigan. Under the sponsorship of Vickers Incorporated, attendance is by invitation only. Co-chairmen of the meetings will be N. S. Smith, engineering superintendent, Pan American World Airways Miami Overhaul Base, and A. C. Ford, superintendent of engineering, Delta C & S Air Lines.

November 2-4: Fall Meeting of the National Fluid Power Association. Edgewater Beach Hotel, Chicago, Illinois.

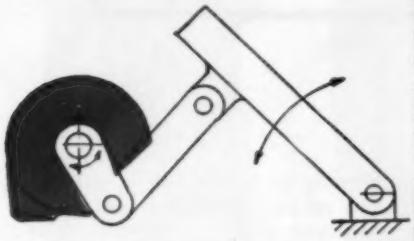
November 14-18: Chicago Exposition of Power and Mechanical Engineering. Chicago Coliseum, Chicago, Illinois.

December 12-16: Nuclear Engineering and Science Congress. Cleveland, Ohio. Sponsored by the Engineers Joint Council. Tentative program covers the advances in more than fifty fields of atom engineering and science.

▼▼▼

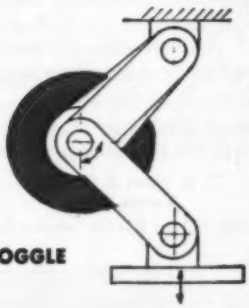


STRAIGHT LINE MOTION
DOUBLE TRAVEL



LIFTING

FIXTURE
POSITIONING
OR
INDEXING



TOGGLE

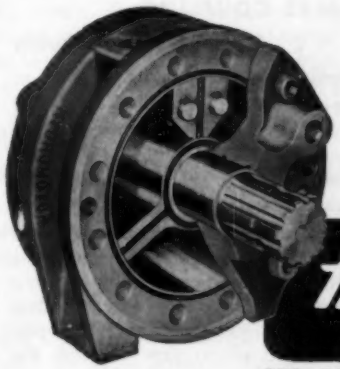
In AUTOMATION (as in countless other ways)

HYDROMOTOR is "On the March"

You can perform all these operations smoothly, positively and efficiently with the Bonnot Hydromotor

Completely sealed and self-contained, the Hydromotor is a simple, dependable, maintenance-free source of *reciprocating rotary power*, installable anywhere . . . at any angle.

Using any hydraulic medium, the Hydromotor develops instant, full torque in either direction through any arc up to 280° . . . may be stopped at any point, reversed, speeded up or slowed down by simple controls. Standard models develop 150 to 300,000 inch pounds torque at 1,000 p.s.i. input. Two vane models, same size, afford double torque values through arcs to 100° —all based on 1,000 p.s.i. oil supply.



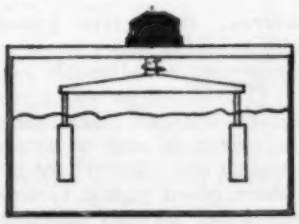
Cleanest Actuator Available—Unsurpassed For Dirt Control.
For complete application and engineering data, write for Hydromotor Bulletin 21, *or outline your requirements.*

NAME OF NEAREST AGENT ON REQUEST

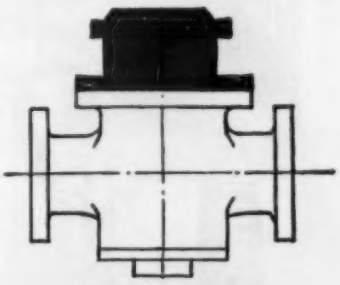
Hydromotor DIVISION

THE BONNOT COMPANY • CANTON 2, OHIO

HIGH TORQUE RATCHET DRIVE



MIXING OR AGITATION
(OSCILLATING ACTION)



VALVE TURNING

Circle 71 on Reader Service Card

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

HYDRAULIC VALVE

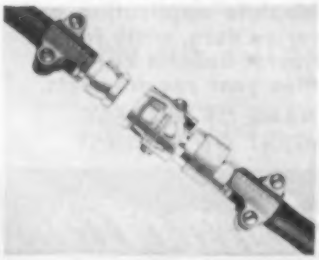
. . . has low power consumption

Designation: Model 6615

Features: This single solenoid pilot operated valve is the subplate type for panel mounting, designed for full 3000 psi. Meets all J.I.C. requirements, features a full capacity rated at 3.6 gpm at 15 feet per second. The unit operates on only 3.6 amps inrush and .45 amps holding at 115 V. Single solenoid has spring return and operates 2 positions on the 4-way valve. It is used with the spool of the valve having all ports blocked in neutral. Roomy wiring box has a terminal strip and is dust sealed. ½ inch conduit connections are provided.

Sizes: Available in ½, ¾, 1 , 1¼ and 1½ inches.

Rivett Lathe & Grinder, Inc.
Boston, Mass.
Circle 150 on Reader Service Card



VALVE COUPLING

. . . is quickly detachable

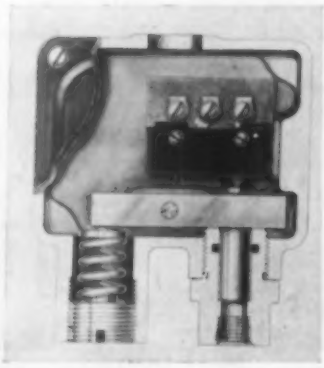
Designation: Quick-As-Wink

Features: To give the operator complete control of the air line, the couplings are designed to permit line air to be shut off and tools changed easily and safely.

Operation: After connecting the jaws of the valve half around the shoulder on the connection half, the operator advances the knurled brass sleeve to "On" position. This permits line air to flow through the sleeve and out through the line to the air operated tool. Turning the sleeve to the right locks both the coupling and the valve in the "On" position, which prevents accidental disconnection. Returning the knurled brass sleeve to the "Off and Exhaust" position exhausts the air in the tool to the atmosphere and traps the line air in the sleeve.

Sizes: Available in ¼, ⅜, ½ and ¾ inch, for line air up to 250 psi.

C. B. Hunt & Son, Inc.
Salem, Ohio
Circle 151 on Reader Service Card



PRESSURE SWITCH

. . . for high speed, automatic operation

Features: Piston type pressure switch accurately senses any system pressure over an adjustable range from 35 to 12,000 psi with a proof range of 4500 to 20,000 psi. A sealed piston is used to simplify installation and eliminate the need for drain return piping. Generous piston travel prevents undesirable actuation from line surges, jarring or vibration. Switch will actuate an electric circuit at any predetermined point on increasing or decreasing pressure. The fixed actuation value varies from 15 to 1000 psi. An external adjustment screw for field setting which is locked in place to avoid its accidental disturbance. The switch also incorporates a snap action switching element rated for AC and DC currents.

Barksdale Valves
Los Angeles Calif.
Circle 152 on Reader Service Card

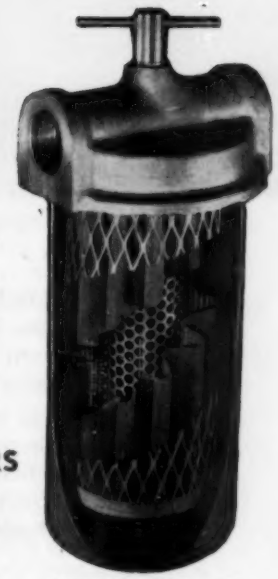
Continued on page 44

Simplify Your Preventive Maintenance

SUMP TYPE (Cutaway)

with

MARVEL SYNCLINAL FILTERS



LINE TYPE (Cutaway)

For All Hydraulic and Other Low Pressure Liquid Systems
SIMPLE, EFFICIENT DESIGN
REDUCES DEMAND ON YOUR SKILLED MAINTENANCE HELP

ANY WORKMAN can disassemble, clean and reassemble Marvel Synclinal Filters. Cleaning is done quickly, and Marvel's extra capacity requires less frequent cleanings. This means more production per machine with less man hours. Marvel protected machines spend their time producing, not in being serviced and repaired. Marvel's BALANCED Synclinal Design and simple efficiency changes down-time to producing time.

STANDARDIZE WITH MARVELS
CHOICE OF OVER 600 ORIGINAL EQUIPMENT MANUFACTURERS

Improve your all-important preventive maintenance by simplifying it. Use Marvel Synclinal Filters throughout your plant. Specify Marvel on new machines, add Marvel to present machines. No moving parts to wear, nothing to keep in stock. Your first cost is your only cost.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

Catalogs containing complete data available on request

MARVEL ENGINEERING CO.
7227 N. HAMLIN AVE., CHICAGO 45, ILL.
PHONE: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters at indicated:

☐ Catalog No. 106 for Hydraulic Oils, Coolants, Lubricants
☐ Catalog No. 300 for Water
☐ Data on filters for fire-resistant hydraulic fluids

AH-11

Name ..... Title .....

Company .....

Address .....

City ..... State .....

WEAR-SAVERS THAT WON'T STEAL POWER

Hydraulic cylinder makers use Chicago Rawhide's Type G wiper seals for many reasons. Here's one: the special Sirvis leather wiper element holds its own lubricant—operates at low friction. This means negligible power loss. Another advantage: the Sirvis leather element will not trap grit and carry it—will not score the shaft. Years of dependable performance have demonstrated the ability of C/R Type G Oil Seals to exclude dirt, dust and moisture. They may be the answer to your problem, too. Write for your copy of "C/R Perfect Oil Seals."

C/R PERFECT Oil Seals

More automobiles, farm equipment and industrial machines rely on C/R Oil Seals than on any similar sealing device.

CHICAGO RAWHIDE MANUFACTURING COMPANY

1301 Elston Avenue OIL SEAL DIVISION Chicago 22, Illinois

IN CANADA: SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO

Other C/R *products*

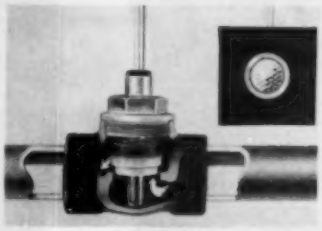
SERVENE (Synthetic rubber) diaphragms, boots, gaskets and similar parts for critical operating conditions • CONPOR: Controlled porosity mechanical leather packings and other sealing products • SIRVIS: Mechanical leather boots, gaskets, packings and related products.

New Products / continued

FLOW INDICATOR
...actuates electrical device

Designation: Model FI-200

Features: Flow through the unit actuates a switch that operates a pilot light, horn, or other warning signal. With suitable relays, it can also operate interlocks. Indicator im-



mediately signals flow stoppages such as those often caused by clogged strainers.

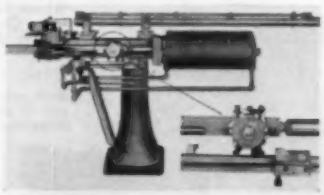
Design: Bronze and inert plastic are used throughout. Lead wires are duplex nylon insulated. The switch unit, hermetically sealed in glass is corrosion resistant, explosion-proof and extremely simple and reliable. Standard pipe sizes are from ¼ to 3 inches. Normally any flow over 1.5 gpm actuates indicator, but other higher or lower flows can be accommodated.

Gems Co.
Newington, Conn.
Circle 153 on Reader Service Card

TUBE BENDER
...has new turret

Designation: Bend-ex

Features: Automatic turret can be set to make a number of different angle bends without any manual manipulation. New turret has up to six



stations. On the return stroke of the racks, a ratchet engages the index finger and advances the turret automatically to the next position. Unit handles round tubing, light angles, channels, and solid bars. Interchangeable dies and jaws do a variety of bending jobs without operator skill. Air operation reduces

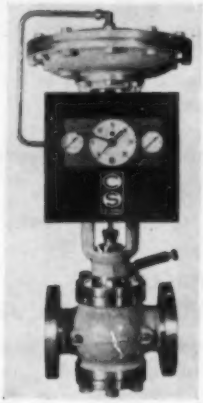
maintenance and replacements. Index finger unit is demountable for manual operation when desired.

Paul Machine Tool Co.
Chicago, Illinois
Circle 154 on Reader Service Card

PRESSURE & TEMPERATURE PILOT
... is air operated

Designation: Type 51

Design: Features include incorporation of process pressure or temperature gage in the pilot, calibrated set point adjustment, unit construction, feedback proportional control with 1 to 100% proportional band and differential gap, and frictionless



power relay incorporating a sapphire jewel nozzle feed orifice with push-button cleaner.

Application: Unit is applicable for pressure ranges from 0-15 to 0-10,000 psi and 0-30" H_2O and 0-30" Hg vacuum. Temperature ranges are from —40 F to 1000 F with mercury-actuated armored capillary temperature-sensing element available with plain bult, union connection or union connection with separable socket.

A. W. Cash Co.
Decatur, Illinois
Circle 155 on Reader Service Card

DUAL LIMIT SWITCH
... has single actuation

Designation: 6AS13

Design: Switch consists of two basic switching units operated by a single roller-lever actuator. Operating point of one switching unit is field adjustable to provide either simultaneous actuation or a definite sequence of operation. Unit is available with a variety of lever lengths, either straight or formed levers, with or without a roller. Positions

Continued on next page

DELIVERS LOW DRAG ON A HIGH PSI PISTON

Specifications demanded a difficult combination. The piston cups of this Midland Bus Door Engine must seal effectively pneumatic pressures ranging from 25 to 125 psi—and create minimum drag in a 6" stroke cylinder. While the cycles are relatively slow in bus door operation, they run as high as 100 per minute on other applications. Special C/R Conpor impregnated Sirvis leather cups provided the answer. Their high tensile strength, excellent resiliency and low sliding friction are particularly suited to applications such as this. After installation, the cylinders have given trouble-free operation . . . opening and closing city bus doors quickly, smoothly, day and night, winter and summer . . . even in long uninterrupted service. Perhaps C/R Sirvis-Conpor packings may solve a similarly difficult sealing problem for you. Get in touch with your nearest C/R Sales Engineer, or send for "Report on Conpor." Write A. P. Barth, Chicago Rawhide Manufacturing Co., 900 N. State St., Elgin, Illinois.

C/R conpor
CONTROLLED POROSITY
SIRVIS MECHANICAL LEATHER

CHICAGO RAWHIDE MANUFACTURING COMPANY
1301 Elston Avenue SIRVIS DIVISION **Chicago 22, Illinois**
IN CANADA: DISTRIBUTED BY SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO
EXPORT SALES: GRON INTERNATIONAL CORP., GREAT NECK, NEW YORK

Other C/R products

OIL SEALS: Shaft and end face seals for all types of lubricant retention and dirt exclusion • SIRVENE: (Synthetic rubber) diaphragms, boots, gaskets, and similar parts for critical operating conditions • SIRVIS: Mechanical leather packings and related products.

a new

LOW-PRICED

radial piston pump

Here is a hydraulic pump that provides the high performance characteristic of piston-type pumps—at a price usually associated only with pumps of vane or gear design.

This is made possible by utter simplicity in design, coupled with a revolutionary "shrink seal" feature, and the economical SECO radial design.

The Model D-5 illustrated is rated at 2000 PSI maximum—5 GPM—at 1800 R.P.M. using 235 SSU oil at 100° F. *The over-all efficiency is above 90% for a wide range of operating conditions.*

A simplified feed-back control with external valving can be utilized to accomplish variable displacement—with resulting advantages, such as constant pressure feed-back control, economy in horsepower, etc.

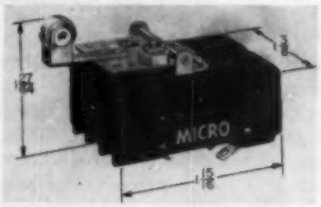
If you use vane or gear type pumps within the range of this new pump, please use the Reader's Service Card for more complete information and prices—

SECO **SERIES "D" PUMP**

SIMPLEX ENGINEERING CO.

ZANESVILLE, OHIO

of levers can be varied to left or right to fit existing applications in which a single-pole, double-throw basic switch was previously used.



Specifications: Each switching unit is rated at 15 amperes 125, 250 or 460 volts ac; ½ ampere 125 volts dc; and ¼ ampere 250 volts dc. Operating force required is 8 oz.; release force is ½ oz.

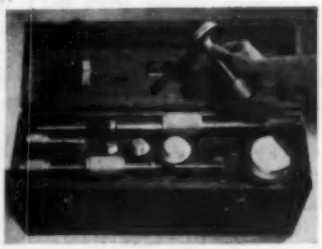
Micro Switch
Div. of Minneapolis-Honeywell Regulator Co.
Freeport, Illinois

Circle 156 on Reader Service Card

SEAL PULLER

. . . prevents damage

Features: Removes all sizes of oil seals from ⅜ inch to 4½ inch. Special sizes are available on order. Set consists of two hammers and six expanding heads which may be purchased as needed. Seals are removed by first selecting the proper size expanding head. Hammer is then at-



tached to the head and inserted into the oil seal opening. Hammer is screwed into the expanding head until the head is snug in the oil seal. With a few taps of the hammer, the oil seal is removed without damage to the seat or surrounding material.

Patton Manufacturing Co.
Springfield, Ohio

Circle 157 on Reader Service Card

For more NEW PRODUCT reviews turn to page 132

Why limit yourself to "STOCK" sizes?

Hannifin can ship the cylinder you need within 48 hours!

(NEW AND EXPANDED PRODUCTION FACILITIES MAKE THIS POSSIBLE)

Any mounting style in:

Series "A" Square Head Air Cylinders—1½" to 14" bore
Series "H" Square Head Hydraulic Cylinders—1½" to 8" bore
Series "LW" Cast Head Air Cylinders—1" to 12" bore

Strokes
As specified to 60"

Rod Ends
Catalog standards, including standard alternates.
Most special rod ends require only 24 hours longer.

Cushions
Either or both ends if required

Quantity
Normally any quantity you need for rush jobs.
For large quantities specify your requirements.

order by phone

When the need is urgent
call long distance.
Experienced sales engineers
will handle your order

CALL HANNIFIN CYLINDER SALES
Des Plaines Number—VAnderbilt 4-0151
From Chicago Phones Only—ROdney 3-4000

Do you have these two newest Hannifin catalogs?

BULLETIN 113—
Series "H"
Hydraulic Cylinders

BULLETIN 213—
Series "A"
Air Power Cylinders

Write for your copies

HANNIFIN

Hannifin Corporation, 545 S. Wolf Road, Des Plaines, Ill.
Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

There is no need for your Hydraulic System to be a maze of valves and piping which is a headache to the erection crew and a nightmare to the maintenance men.

Benjamin Lassman & Son offers what might be called a "Graduate Level," as contrasted to the "Catalog Engineering" approach in the design of hydraulic circuits.

By way of example, take a cylinder which, driven by a single pump, is to have perhaps three or four different but independently adjustable speeds during its operating cycle. The conventional solution suggests the use of flow control valves, one for each speed, in combination with electrically operated shut-off valves to permit the necessary selectivity. This means a lot of valves and a lot of piping, all of which operate at full system pressure.

Now picture the same problem solved using no hydraulic valves at all and doing a better job by eliminating the shocks created as the various valves are cut in or out!

Or take the instance of raising and lowering a load which is variable to a maximum of 180 tons, yet which must be moved smoothly and at constant speed regardless of the value of the load. The conventional schemes come to mind quickly, but LASSMAN design meets all the requirements and yet uses no directional control, flow control, relief or counterbalance valves!

Yes, LASSMAN designed circuits aim to provide you with the better and simpler way of doing a job hydraulically. And if you combine the advantages of LASSMAN systems with LASSMAN quality equipment, you'll have a better understanding of what we mean when we speak of "quality performance" . . . performance which can be yours. May we have the opportunity of quoting on your requirements?

Quality EQUIPMENT for *Quality* PERFORMANCE

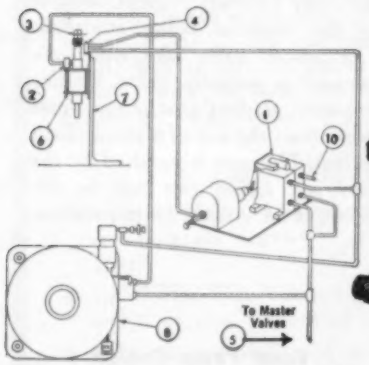
BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA.

THE NEW IMPROVED *Fluid Feed* ROTARY WORK FEEDER *IN ACTION!*

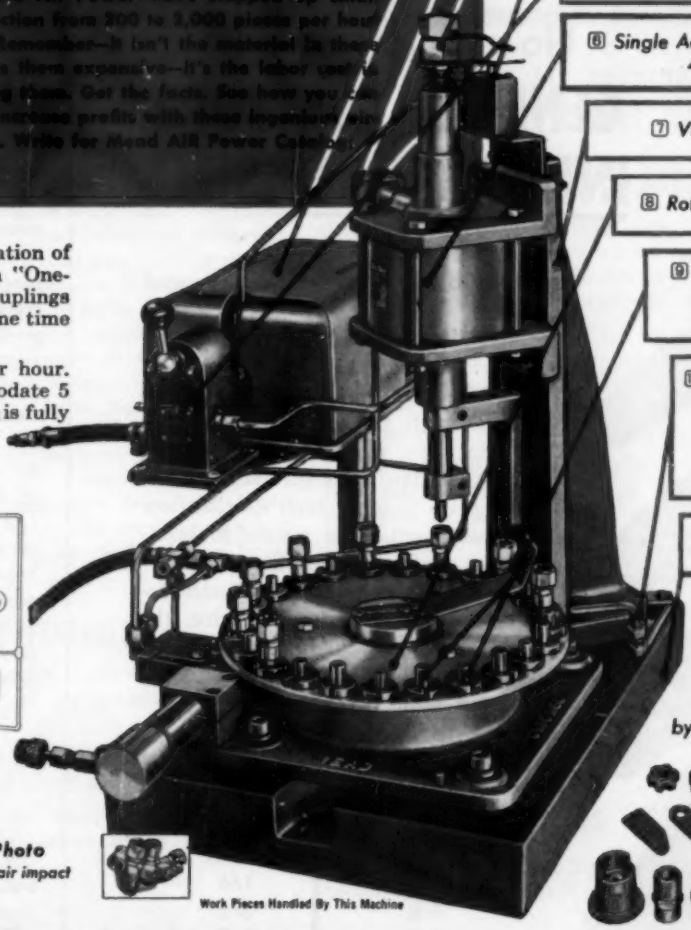
THIS and other Mead Work Feeders—using clean, inexpensive Air Power—have stepped up small piece production from 200 to 2,000 pieces per hour and more! Remember—it isn't the material in these "small piece" jobs that makes them expensive—it's the labor cost in loading, holding or assembling them. Get the facts. See how you can save time, money, labor and increase profits with these ingenious air operated MEAD Work Feeders. Write for Mead AIR Power Catalog.

A simple and inexpensive combination of Mead pneumatic devices makes a "One-Man Factory" to assemble brass couplings by flaring neck into nut, at the same time forming a fluid-tight seat.

Output approximately 2500 per hour. Two sets of 12 mandrels accommodate 5 different styles and sizes. Operation is fully automatic except for loading.



Circuit Diagram of Units in This Photo
Combine readily to feed work to drill press, air impact hammer for a wide variety of operations.



Work Pieces Handled By This Machine

1 Model 2 Meadmatic Timer
2 #2 Quick Exhaust Valve to speed up return stroke
3 Adjustable depth stop with spring return
4 Cycle release valve (included with timer) to reverse cycle at end of down stroke
5 4-B Master Valve starts and stops entire system
6 Single Acting Cylinder, 4" bore
7 Vertical Stand
8 Rotary Work Feeder
9 Alternate mandrels for two sizes of brass couplings
10 Air blast ejection of finished parts, by jet piped from second of two valves in timer
11 Universal Base

Typical Work Pieces Handled *by Mead work feeders*

MEAD SPECIALTIES COMPANY, Dept. AH-115, 4114 No. Knox Ave., Chicago 41, Ill.

Memo Coupon

MEAD SPECIALTIES CO.
4114 N. Knox Ave., DEPT. AH-115, Chicago 41, Ill.
Send free copy of new, colored MEAD INDUSTRIAL AIR POWER CATALOG describing the complete line of famous Mead air-operated devices.

Name_____

Company_____

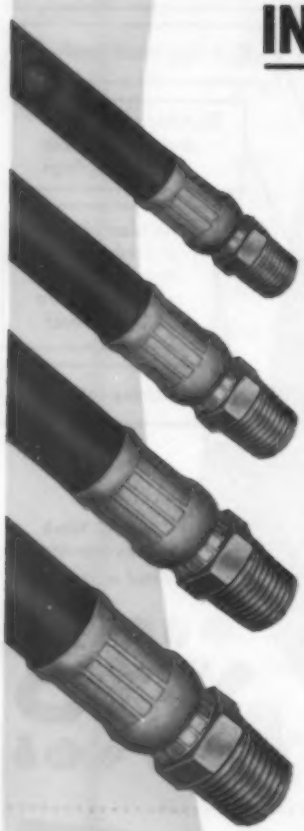
Address_____

City_____ Zone____ State_____

CONTROLLED PRESSURE crimping process attaches FUL-BORE coupling *permanently* to single or double wire braid hose. This process assures longer life under extreme static and surge pressures.

No misfit Hose with

GENERAL FUL-BORE INTERMEDIATE SIZES



■ With General's complete range of sizes, you need not accept a hose assembly that's "nearly right" for your application.

Flow requirements determine the hose size to be used. These intermediate sizes, pioneered by General, plus standard sizes, give you a wider selection to meet each specific flow requirement. This results in maximum performance and economy.

Where an intermediate size replaces a larger standard size, the assembly will take higher pressures, have greater flexibility and longer life at lower cost.

Intermediate Sizes	Standard Sizes
5/16	3/16
13/32	1/4
5/8	3/8
7/8	1/2
	3/4
	1

Follow the big name manufacturers of heavy duty equipment . . . Specify **GENERAL HOSE** *— custom-engineered to each requirement.*

HOSE AND COUPLING CO.

409 BROAD AVENUE • PALISADES PARK, N. J.

LETTERS to the editor

Use a Limit Switch, Maybe?

On page 79 of the July issue, the article, "Counter Actuates Solenoid Valve to Stop Piston Travel", is very interesting. I may be overlooking something but why not mount a limit switch directly on the sliding arm and so cut out all the complication of an electronic counter?

D. DAWSON
Derbyshire, England

Accuracy is the reason the counter device is used in preference to a simple limit switch. A limit switch is often used to signal the reversal of a piston or to stop piston travel. However, it can not signal this reversal as rapidly as can be accomplished with an electronic counter. On the particular machine described in the article, accuracy was very critical, because of the material being stretched. The set-up using the electronic counter is actually quite simple; however, it does cost many times more than the use of a single limit switch. The cost is justified by the accuracy which can not be obtained with simple limit switches.

Vane Pump Design

Can you supply us with information about the design of hydraulic vane pumps? Any list of publications, or texts containing design calculations and data would be appreciated.

J. D. HOPKINS
Rochester Products Div.
Rochester, N. Y.

We've sent you a copy of a bibliography prepared early this year which will offer some suggested sources. We are now compiling a complete index to all published material we can locate on the subject of fluid power. This index,

Continued on page 52

Logan RFL unit

Keeps Your Air-Operated Equipment Working At Full Capacity

MAINTAINS UNIFORM AIR PRESSURE, FILTERS AIR, LUBRICATES AIR CYLINDERS, VALVES, TOOLS

To assure capacity performance under all conditions, install the new Logan "R-F-L Unit" wherever air power is used in your plant and on the equipment you are marketing. Uniform working pressure is maintained by leveling out surges and sudden drops in the air supply. Clean, moisture-free, oiled air is supplied to assure unfailing operation, minimize wear of working parts, and increase service life of packings. The R-F-L Unit is installed in the intake line from the main air line, and can be mounted on a central control panel. Its compact, clean lines harmonize with the modern styling of your latest equipment. All components are conveniently visible on and controlled from the front panel. The upper and center knobs regulate the air pressure and oil flow, respectively—the lower knob drains the water trap.

FUNCTIONAL FEATURES

- Long life-piston-type reducing valve with long travel for accurate regulation of air pressure. Pressure gauge.
- Lubricator with control knob, oil level sight glass and filler plug located on front panel of unit.
- Removable ribbon-type air filter element to trap scale, rust, other foreign matter and water. Large water reservoir.

WHAT IT DOES

REGULATOR—Piston-type reducing valve with long travel of control permits accurate regulation of pressure from main air line as required by work. Keeps working pressure uniform with minimum air consumption.

FILTER—Supplies clean, dry air to system, thus assuring uniform and trouble-free operation. Replaceable filter element separates scale, rust and other foreign matter from air. Moisture drips into a reservoir which requires draining only once or twice a week.

LUBRICATOR—Automatically injects oil into air intake line to lubricate valves and cylinders, prevent corrosion and increase life of parts and packing. Metering needle adjustable as required by installation.

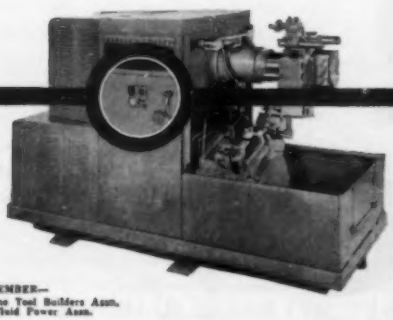
Eliminates piping, elbows, tees and reducers between components. No pipe friction.

HOW IT IS CONTROLLED

Two knobs on front panel accurately regulate air pressure and amount of oil injected as required by the individual job.

HOW IT IS INSTALLED

Install in the air intake line from the main air line. Can be mounted on a central control panel.



Illustrated — Single spindle automatic chucking machine with Logan R-F-L Unit installation. Photo courtesy Warner & Swasey Co.

MEMBER—
National Machine Tool Builders Assn.
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Logan — Saves Time — Logan Air and Hydraulic Equipment — Quiet • Motion

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Let Logan engineers help you design your Air and Hydraulic Circuits. No obligation.

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HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

National offers you

Top quality O-Rings, dependably uniform, delivered on time!

Here's the way National insures uniform high quality in National O-Rings:

All ingredients are of highest quality, carefully inspected before compounding. Compounding is done under strict controls to insure absolute uniformity of batches. Molding is done on modern equipment by skilled veterans in O-Ring manufacture. Rings are given a complete precision trim, then complete inspection. Every precaution is taken to insure that no O-Rings with cuts, scratches or mold defects are shipped.

A complete line of industrial O-Rings, including the new small cross-section rings, is available for prompt shipment from convenient warehouses. Prices are most competitive. Call the nearest National Applications Engineer and prove this to yourself!

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OIL & GREASE SEALS
O-RINGS SHIMS

NATIONAL MOTOR BEARING CO., INC.

GENERAL OFFICES: REDWOOD CITY, CALIFORNIA
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DALLAS, TEXAS ... 30½ *Highland Park Village, JUstin 8-8453*
DETROIT, MICH. ..... 13836 *Puritan Avenue, VErmont 6-1909*
DOWNEY (Los Angeles Co.), CAL., 11634 *Patten Rd., TOpaz 2-8166*
INDIANAPOLIS, INDIANA . 2802 *North Delaware St., WAlnut 3-1535*
MILWAUKEE, WIS. ... 647 *West Virginia Street, BRoadway 1-3234*
NEWARK, N. J. .. *Suite 814, 1180 Raymond Blvd., MItchell 2-7586*
REDWOOD CITY, CALIF. .. *Broadway and National, EMerson 6-3861*
WICHITA, KANSAS ..... 519 *South Broadway, WIchita 2-6971*

LETTERS to the editor

which will cover 25 years of published material, will appear in the January, 1956 issue of APPLIED HYDRAULICS. *The index will be broken down into more than 60 classifications, and there will be numerous cross-references to make it simple to locate material. If readers want extra copies of the January issue, they should be ordered now.*

Wants a Magnetic Plug

I read J. R. Hemeon's very interesting article "Changing to Fire Resistant Fluids" which appeared in the July issue. Could you tell me the source of the magnetic plugs that he mentioned using in the tank for trapping abrasive particles?

DONALD KITCHIE
Grayson Control
Downey, Calif.

Sources for magnetic plugs and magnetic filters have been forwarded.

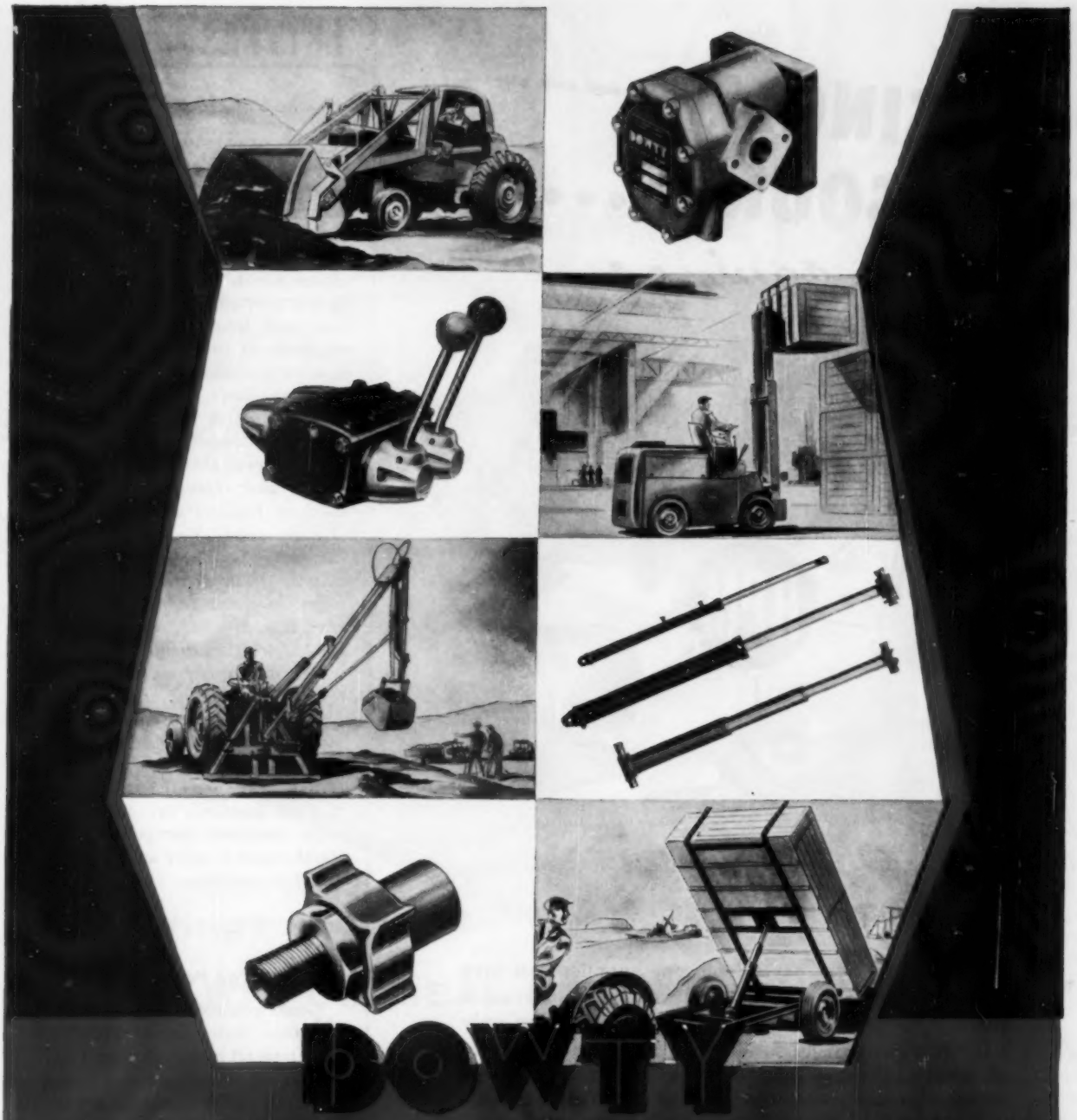
Info About Standards

We have been able to discover that J.I.C. refers to Joint Industry Council on Hydraulic Standards for Industrial Equipment. The name implies that this committee has compiled sheets of engineering standards and made them available to design engineers. We will appreciate your advising us how to obtain such a manual or set of data sheets. Likewise, we are interested to know if, in your opinion, this J.I.C. is accepted in preference to S.A.E., Federal or other military specifications as a standard for hydraulic design.

ROBERT L. McDONALD
Ritter Company, Inc.
Rochester, New York

Since your company manufactures equipment for the dental and medical professions it is quite understandable that you are not familiar with the Joint Industry Conference Standards. This con-

Continued on page 54



DOWTY

Hydraulic Units

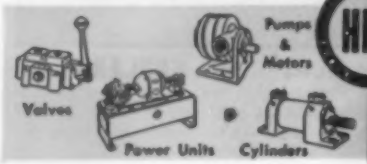
- High efficiency pressure-balanced pumps up to 2,500 p.s.i., in a range of 14 sizes.
- Single or banked unit Control Valves.
- Standard Rams in a wide range of sizes for all types of duties.
- Quick release self-sealing Couplings for hydraulic pipelines.

DOWTY HYDRAULIC UNITS LIMITED • ASHCHURCH • GLOS • ENGLAND

DOWTY EQUIPMENT OF CANADA LTD. • AJAX • ONTARIO
DOWTY CORPORATION, 25 BEAVER STREET, NEW YORK, 4
Members of the DOWTY Group

Buying component parts from one supplier can save a lot of time and trouble . . . less correspondence, a single responsibility, coordinated shipments are only a few of the many advantages. H-P-M's complete line of pumps, power units, valves, cylinders and system accessories can become your standard. This complete service plus H-P-M's experience background in the design and building of hydraulic systems can be a really major "assist" when needed. Write today for a complete catalog and get the facts on single source savings. Ask for Bulletin 1101.

HYDRAULIC PRESS MFG. COMPANY
1084 MARION RD.
MOUNT GILEAD, OHIO, U.S.A.



HYDRAULIC POWER DIVISION

LETTERS to the editor

ference was organized in 1948 primarily by the automotive companies who wanted to develop minimum standards for machines built for their plants. They were primarily interested in getting machines which would be designed so that they could be readily serviced, and would operate with a minimum of downtime. Also safety is a consideration in establishing these standards.

The conference which worked out these standards included representatives of the automotive companies and representatives from machine builders and component manufacturers. You can obtain standards for hydraulics, pneumatics, electrical and lubrication from the Joint Industry Conference, P.O. Box 182, Northend Station, Detroit 2, Michigan.

The standards have no relation to SAE or federal and military specifications. They have become quite important because the automotive industry is a large purchaser of equipment. You will find that the standards are only minimum standards for good design which result in safer and easier to maintain machines.

Wants Large Pump and Motor

Could you put us in touch with a United States manufacturer of vane type oil hydraulic pumps and motors capable of speeds varying from 0 to 1000 rpm with a volumetric capacity up to 50 cu in per revolution. Working pressures should be 1500 psi.

WALTER S. LEWIS
Barton Hydraulic Engineering Co. Ltd.
Sunderland, England

We have sent a list of vane pump manufacturers who make pumps and motors capable of operating at 1500 psi. The motors can be driven at speeds from 10 to 3600 rpm; however, your capacity requirement of 50 cubic inches per revolution is quite high for a vane pump. At 1000 rpm, this would

Continued on page 56

New...

for machine designers and users...

Seals for special applications

Machine design data

Installation instructions for split Clipper Seals

Uses in various industries

Interesting case histories

Recommendation tables

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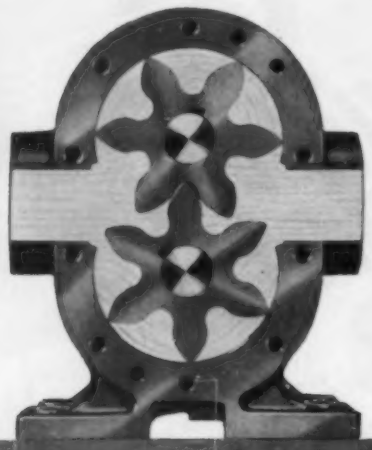

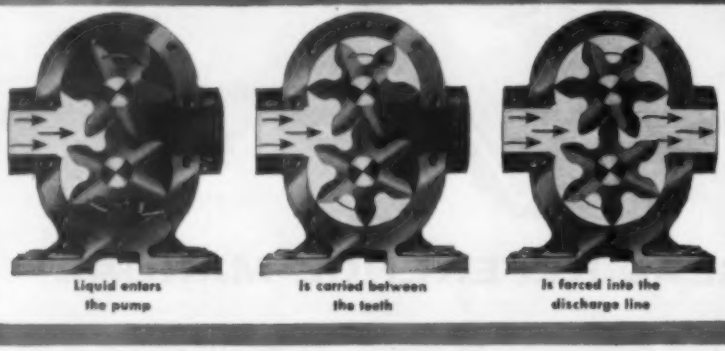

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ROPER
Rotary Pumps

LETTERS to the editor

give a displacement of about 216 gpm, which is beyond standard vane pump sizes.

Correction for Master Catalog

In the instructions on Methods for Computing Length of Hose Assemblies, page 459, Hose and Hose Fittings subsection of section 5, Engineering and Technical Data, there is a slight typographical error. In the second paragraph, lines 2 and 3, the mathematical sign $\times$ is used for the capital letter X. However, since lines 3 and 4 of this paragraph explain what X is, there should be no misunderstanding in the use of this formula.

In the fourth paragraph, beginning: Relative Motion Installation, the same symbol has been used for the capital letter in line 6. In line 8 the capital letter X has been used in the formula instead of the mathematical sign. The formula should read $L = 2A$ plus X plus T.

We particularly regret this since this material was used by permission from copyrighted literature of a leading manufacturer of hose, hose couplings and hose assemblies.

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I have a problem of dividing the flow of a small quantity of oil at low pressures. I would appreciate a list of manufacturers that could aid me. The quantities of oil are less than .5 gpm.

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Useful Literature

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NYLON TUBING . . . for air, oil and gas applications is described in a folder published by The Polymer Corporation. Designated Nylaflow, the tubing has excellent resistance to flexural fatigue. Hornlike in nature, it is a tough durable tubing which will withstand abrasion. It is also resilient. The tubing is unaffected by gasoline and greases, and is resistant to other chemicals and corrosive atmospheres with the exception of formic acid and concentrated mineral acids or phenol. It is very light, less than half the weight of aluminum. Tubing can be made available in several colors to make identification of lines easier. The folder shows possible uses, and gives standard sizes and length in which this tubing is now supplied.

Circle 210 on Reader Service Card

VALVES... for aircraft fuel, special fluids, and hydraulic systems manufactured by Fluid Regulators Corp. are reviewed in a brochure offered by the company. The company's products include jet fuel pump relief valves and small solenoid valves for special fluids. The brochure indicates manufacturing processes such as hardness testing to ensure proper heat treatment, anodizing for protection and appearance, and microscopic inspection of critical areas where tolerances alone are not a measure of acceptability.

Circle 211 on Reader Service Card

HYDRAULIC PISTON PUMPS . . . For industrial and agricultural applications, available in two models—Model 444-4 cylinders and Model 400-2 cylinders—are described in data sheets prepared by Williams Machine & Tool Co. These positive displacement pumps feature built-in 3-way control valves having output, hold and return positions. Built-in relief valve is preset at factory up to 2500 psi. A single line from pump to cylinder serves both for pressure and return. Rotation is in either direction. Exploded views of these two units show all the parts. Typical applications are illustrated.

Circle 212 on Reader Service Card

INDUSTRIAL SWITCHES . . . Photographs, dimension drawings, circuit diagrams, electrical data and complete technical information on 90 different switches are presented in a new 28 page catalog published by Micro-Switch, a Division of Minneapolis-Honeywell Regulator Company. Covered are heavy-duty limit switches, sealed switches, general purpose switches and many others. Designed for use on either alternating or direct current industrial applications, the switches are available in a variety of actuator designs, contact arrangements and electrical ratings.

Circle 213 on Reader Service Card

AIR OPERATED DEVICES . . . Mead Specialties Company offers a comprehensive catalog on pneumatic devices made by the company. The examples described in the book are actual production units to do particular jobs. While they might be described as custom machines, they are actually a number of standard units combined to solve production problems. The catalog illustrates many of these units, explains their operation, performance and shows typical hookups. One page of this brochure is devoted to the manufacturers who have installed some of these pneumatic devices.

Circle 214 on Reader Service Card

HYDRAULIC SEQUENCE VALVE . . . Designed for aircraft hydraulic systems for 3000 psi service, the new series 4000 line, manufactured by Aircraft Products Co., is outlined in a 4 page bulletin. These slide-type valves offer low leakage and low pressure drop. The valves are available in either plunger operated or lever operated models. A new design feature can be provided which insures a pressure drop only one-third as much as that found in conventional valves of this type. The literature includes photographs and complete specifications for both models.

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ELECTRIC MOTORS . . . manufactured by Howell Electric Motors Company are discussed in a new catalog. The company makes motors in a range from 1/6 to 50 horsepower which can be furnished for any standard or special voltage from 24 volts to 4800 volts. Constant speed motors operating from 0 to 28,800 rpm are available, and two, three or four speed operations may be attained with multi-speed motors. They are built in approved frame sizes in all ratings and sizes covered by NEMA standards. A variety of enclosures and various types of cooling methods are also featured, as well as mountings and other characteristics. Performance data and applications of various types of motors are included.

Circle 216 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 146

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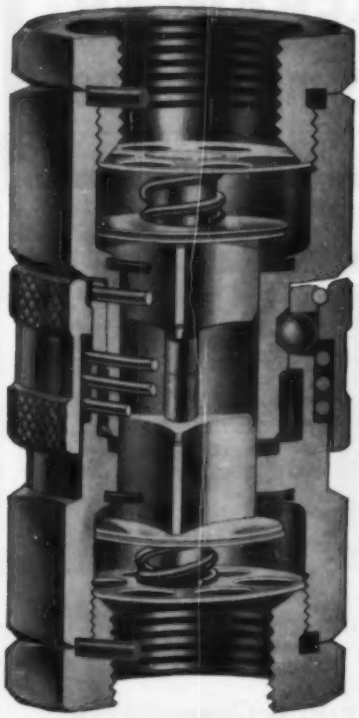

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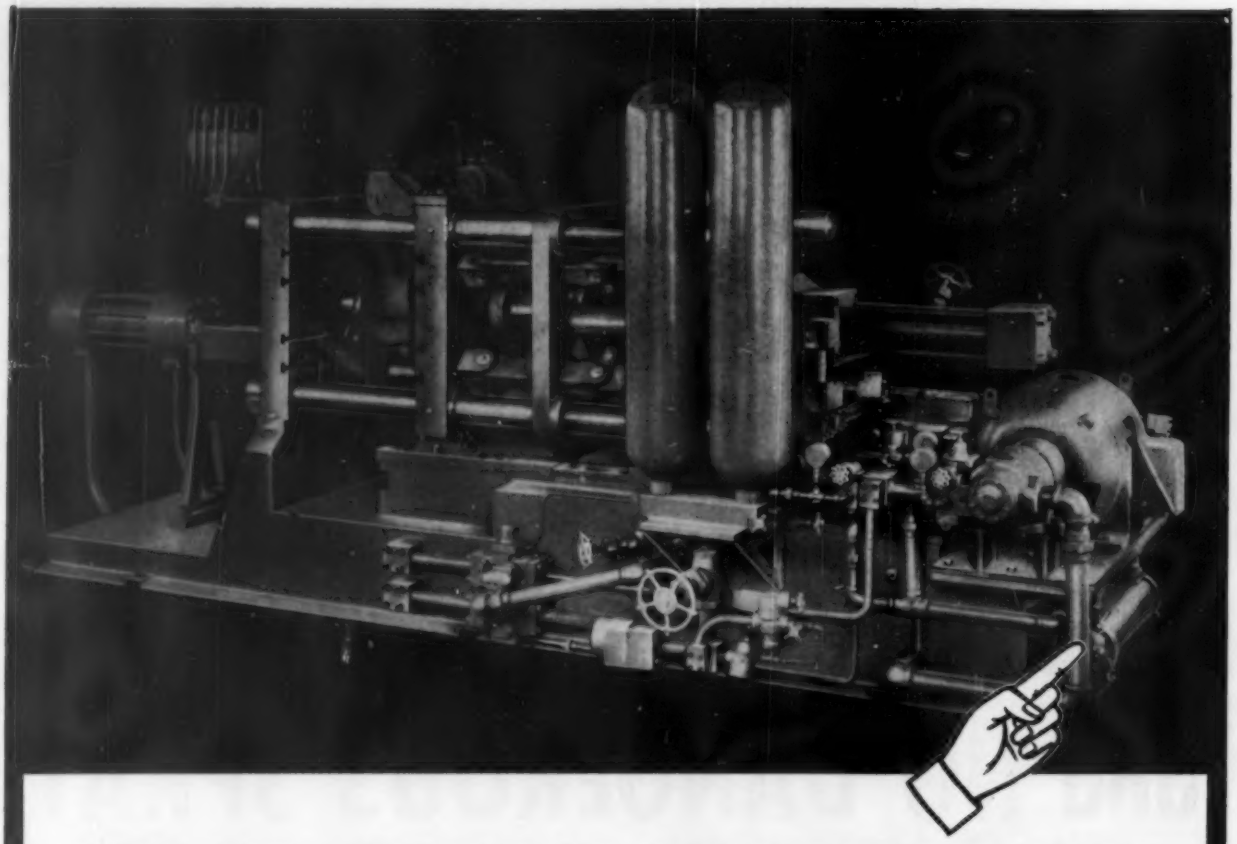

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For detailed information, request Bulletin 1.1K5.

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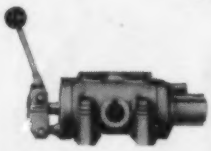

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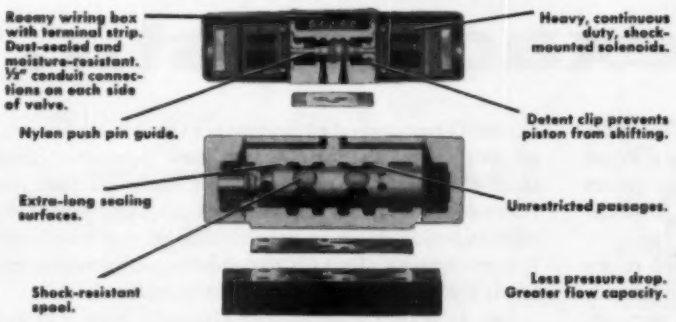
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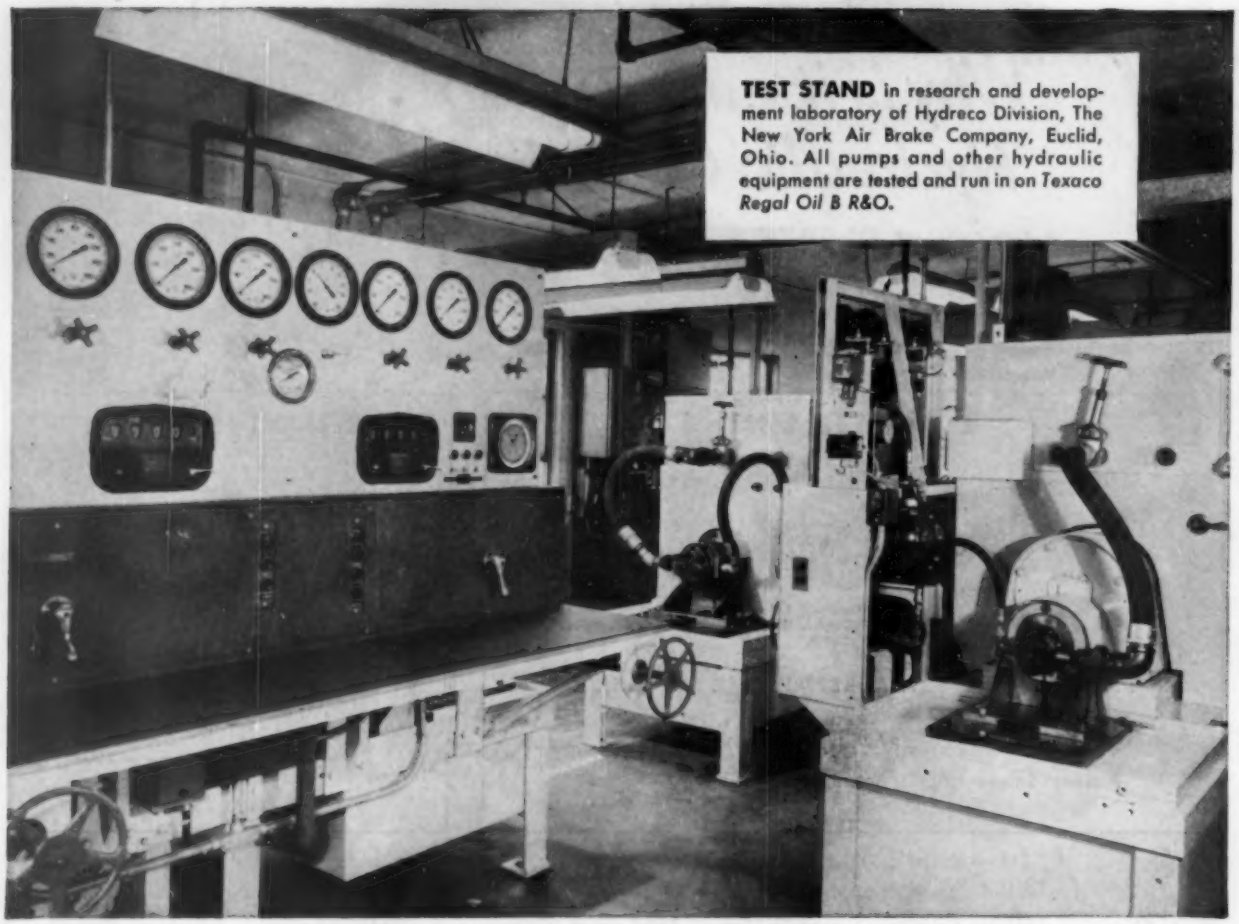

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TROUBLESHOOTING HYDRAULIC EQUIPMENT...

what's the best procedure?

Whenever you ask a maintenance man what's the best procedure for troubleshooting hydraulic machines, he'll probably shrug his shoulders and say, ". . . depends on the situation—what equipment, what trouble, what tools you've got, how well you know the machine." To learn what techniques are used when machines fail, APPLIED HYDRAULICS surveyed 150 maintenance men in various industries and different parts of the country. Here's a round-up of what these men had to say.

What are the most common troubles affecting hydraulic equipment?

Leakage is the biggest problem, and almost every company reports this trouble. Sluggishness, noise, and low pressure are also common problems. Sticking valves were reported by many companies and this is probably part of the cause of sluggishness and other malfunctions. One firm is troubled by air in the system after a week-end shut-down. Another company has had difficulty maintaining the machine cycle, and this may be due to a component in the electrical system.

There are many interesting solutions to the problem of leakage. Many companies are eliminating pipe threads and are using welded-flange pipe with O-ring seals. Some firms have developed their own flanges for use with neoprene seals. Another solution to the leakage problem is the use of extreme care in preparing tube flares and in the proper sealing of pipe threads. One company says that silver soldering all joints except union couplings has helped. There has been some use of new-type fittings —some are self flaring. The elimination of bends and traps in piping and fittings has helped in some cases, and repacking components periodically is an aid. Close surveillance and a good preventive maintenance program are suggested. Some firms believe that manifolding components is part of the answer. Excessive vibration is a good source of leaks and this vibration should be reduced as much as possible. Heat reduces the oil viscosity and increases leakage, so the installation of an oil cooler may be a solution in cases of hot oil. One automobile manufacturer has set up specifications for some new equipment which are more stringent than JIC Standards. At least one company has taken the easiest way out and has designed their machines in cabinets, so that leakage returns to tank. Then there's always sawdust . . .

What hydraulic components fail most often?

Seal wear is probably the reason for most of the failures of valves and cylinders. Undoubtedly this is a basic cause of sluggishness in hydraulic systems, with worn seals slowing down cylinders and preventing rapid valve action. Pumps seem to rank

with valves and cylinders in frequency of failures. One maintenance supervisor operating automatic machines says that in his experience, ". . . pumps fail about twice as often as valves or cylinders." Fluid lines frequently require replacement, and often this is done with new fittings. Gaskets seem to have low maintenance requirements but are usually replaced when the valve or other component is disassembled. Some trouble with fluid motors was reported, and these are subject to similar problems of wear as their counterpart pumps. Clogged strainers were reported as a trouble though this should more properly be taken care of as part of a planned maintenance program. Some firms have removed all strainers and use a portable filter 4 or 5 times a year.

What equipment is used to locate troubles?

The pressure gage is to the hydraulic technician what a voltmeter is to the electrician, and it's pretty hard to diagnose most troubles without one. Thermometers are often used to determine the temperature of the oil. Hot oil can cause frequent valve failures because of damaged seals. A redesign of some of the piping, the installation of an oil cooler, or use of a larger tank and more oil usually corrects the trouble.

Tachometers are being used to check pump and fluid motor speeds and spindle speeds where synchronization is required. Stroboscope tachometers are also used for very accurate readings. Where a machine must perform several operations in sequence, a stop watch is used to check the performance. Not only is this required in setting timers, sequence valves, and other cycle controls, but it also tells the maintenance man whether the machine is following a consistent cycle.

Standard electrical instruments are required for checking the electrical system. Voltmeters and clip-on ammeters that permit reading currents without disturbing the wiring tell much about performance of electrical components. Ohmmeters can be used to check continuity of wiring and to locate loose connections.

Some of the larger companies have test stands for checking components and systems. Usually only a considerable amount of hydraulic equipment warrants a test stand, and those companies reporting them include manufacturers of machine tools, farm equipment, and automobile transmissions. But the best tool of all is one's own understanding of the machine operation, and one company listed "mental analysis and investigation" as their most valuable tool.

What is the best method of tracing trouble in sandwich or drilled manifolds?

Manifolds cut down the number of pipe threads and fittings required and therefore eliminate many potential leakage points. In addition, they eliminate many long tubing runs which would be subject to vibration and fatigue failures.

Before removing any of the installed components there are certain checks that can be made on the manifold. One procedure is to check the operation of each valve to determine if the trouble is in the manifold or valve. If the manifold is properly marked and the drawings are available, the circuit can be traced through the manifold. It may be necessary to remove the manifold and disassemble the valve. A rather simple set-up for locating cracks is the use of a rubber tube for blowing smoke into the manifold. Another method for locating cracks and plugged holes is by plugging the connections and observing leakage with the manifold under pressure. The manifold with all components removed is installed in a fixture. Self-sealing connectors are installed in all ports and air at 85 psi is admitted to each circuit of the manifold. Tightness of the manifold is checked by closing off the pressure supply and observing that pressure is maintained in each circuit of the manifold.

Free flow through each circuit is tested with a flow meter connected in turn to each port measuring the flow of air at 85 psi. Use of air

Continued on page 122

PISTON RINGS for HYDRAULICS

● By Ernest J. Taschenberg and John W. Pennington

How effective is a metallic piston ring for sealing a reciprocating hydraulic piston? Here is basic information on the development of metallic sealing rings. Effective use of the proper sealing ring also requires consideration of dimensions and finishes of the hydraulic cylinders and pistons.

FOR many years, split metallic piston rings have been used to seal reciprocating motion of both external and internal cylindrical surfaces against the leakage of fluids. This use has increased very rapidly during the past few years. Some of the reasons for this increase are:

1. Higher temperatures make it necessary to use all metallic parts in many applications.
2. Higher pressures make it necessary to increase the strength of the sealing members.
3. Wide differences in expansion of parts during heating and cooling make it necessary to have a sealing member which can accommodate changes in size. The split piston ring with an overlapping joint can take care of relatively wide changes in size of the cylinder.
4. Increased accuracy of manufacture of the piston rings and mating parts has made it possible to reduce leakage to a small percentage of that which was considered satisfactory not too long ago.

ERNEST J. TASCHENBERG, *Project Engineer*, JOHN W. PENNINGTON, *Manager, Technical Department, Koppers Company, Inc. Metal Products Division, Baltimore, Maryland.*

Probably the greatest advantage of the piston ring type seal is that with a properly designed joint, it can accommodate relatively large changes in temperatures of the cylinder or rod and still maintain an effective seal.

DESIGN FACTORS FOR METALLIC SEALING RINGS

The basic piston ring is the split rectangular section expanding ring having a thin wall. By shaping the ring, a gap is formed in the unrestrained ring which causes the ring to act as a spring when confined in a cylinder. By controlling the shape of the ring, relatively uniform bearing pressure is obtained

between the ring and cylinder; the pressure depending on the free gap, the modulus of the ring material, the moment of inertia of the ring cross section and bearing area of the ring. The outside diameter of the ring bearing uniformly against the cylindrical surface forms one of several important sealing surface pairs. It should be noted, however, that the contact of this sealing surface pair is interrupted at the ends of the ring.

The second important sealing surface pair is produced by contact between the side of the ring and the side of the ring groove or land. Contact of these surfaces is also interrupted by the end clearance of the ring. Since the spring action of a ring is in a radial direction only, the ring can in no way produce contact between the side of the ring and the ringe groove through its spring action. Obtaining contact between these surfaces depends on the use of a separate spring such as a wave washer or on the action of fluid pressure on the side of the ring.

To better understand the process of establishing a seal using the simple split ring, the case of a static hydraulic cylinder, piston and ring, like the arrangement in Figure 1, will be examined. The ring is initially bearing against the cylinder as a result of its spring tension. The vast majority of applications depend on fluid pressure rather than a spring to produce contact between ring side and the ring groove. The bulk fluid pressure P_o is transmitted to the ring through the clearance between piston and the cylinder. The pressure differential acting over the side area of the piston ring forces the ring into contact with the ring land. Once seated against the ring land, the pressure differential adjusts to a steady value which maintains contact between the ring and ring groove forming the second important sealing surface pair.

The ability of the simple split piston ring to produce an effective seal is limited then by the amount of end clearance existing in the ring. The actual leakage path is a rectangular orifice having as dimensions the end clearance of the ring and the radial clearance between the piston and cylinder. This orifice is shown in Section AA, Figure 1. To obtain the least amount of leakage, it would be necessary to have the ends of the ring butt. This approach to minimize leakage is not satisfactory because differences in thermal expansion, dimensional tolerances and wear ultimately result in a finite end clearance or else in butting of ring ends under high stress. The latter may cause piston seizure, cylinder scuffing, or ring breakage.

With high temperature and high pressure applications, the simple split piston ring does not provide a satisfactory seal unless large leakage values are permitted which in turn permits the use of a sizeable end clearance. Various piston ring joints and multi-piece ring designs have been developed over the years for the express purpose of improving ring sealing ability and at the same time, compensating for variation in dimensions resulting from tolerances, wear and differential thermal expansion.

BASIC RING DESIGN

The various metallic sealing ring designs may first be divided into two groups, that is, one-piece rings and multi-piece rings. These groups may be

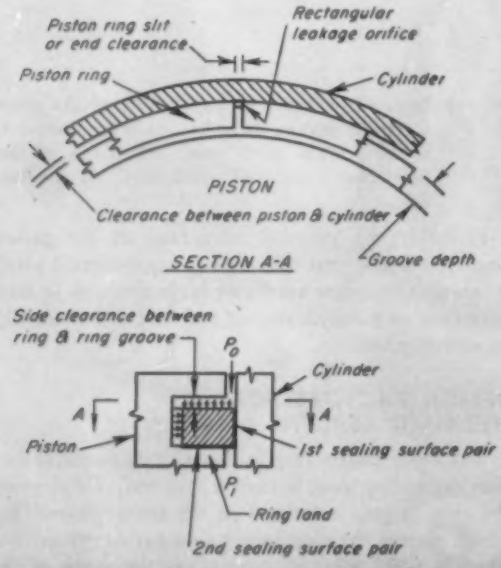


FIG. 1. Sealing surface pairs of a straight cut ring

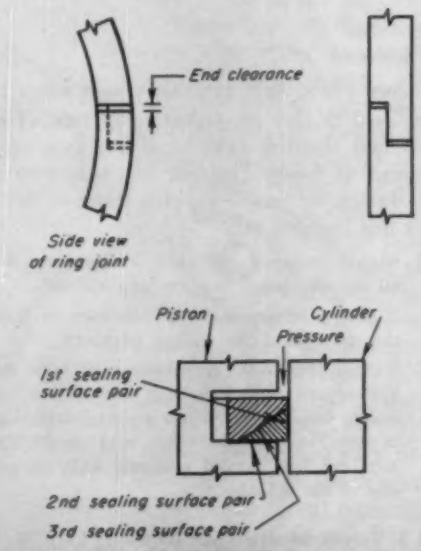


FIG. 2. Step seal joint has 3 sealing surfaces

further divided according to whether the ring seals in one axial direction only or in either axial direction. To help explain the function of the ring joint, it is best to first consider the one-piece ring which seals in one axial direction such as the step seal ring shown in Figure 2. The step seal type joint provides two additional surfaces which form the third important sealing surface pair. The variation in dimensions which limit the effectiveness of straight cut joints are eliminated since relative motion may take place along these surfaces without opening a leakage path.

Multi-piece rings are primarily designed for sealing in either axial direction by making use of more than one ring having less complex joints to simplify manufacture. The best example of this is the three piece compressor ring having simple straight cut joints as shown in Figure 3. This ring design forms a seal in the same way as does the spilt compression ring except that the second outer ring forms a seal across the side of the joint to prevent axial flow and the inner ring forms a radial seal across the back of the joint.

The two-piece ring, Figure 4, having a step joint outer ring and a straight cut inner ring also provides a seal in either axial direction. The step joint on the outer ring does not form a seal by itself but combined with the inner ring prevents fluid flow in the axial direction while the inner ring seals across the end clearance to prevent radial flow.

Another type of two-piece ring, shown in Figure 5, for sealing in either direction makes use of two identical rings installed side by side in a groove. A step joint is also used on these rings but the joint appears as a step when viewing the side of the ring contrasted to the step on the OD of the outer shown in Figure 4. When one ring is seated against the cylinder and the ring land with the second ring seated against the cylinder and the side of the first ring, the step joint of the first ring prevents flow in a radial direction and the second ring prevents axial flow through the end clearance. This ring assembly produces a seal which may be very narrow in width and has the additional advantage of being made up of two identical rings.

The step seal ring may also be used for sealing in two directions by installing two of these rings side by side in a groove with the "pressure" sides of the rings in the middle of the groove. Compared to the other two piece rings described, the seal formed in either direction is produced completely by one ring, independent of the other and as a result, sealing depends only on the three surface combinations described in the step seal discussion. Here again the rings are identical but must be installed in the groove with definite orientation.

MATERIALS

The most commonly used piston ring material is a high grade, closely controlled cast iron. This material gives a good combination of wear life, resistance to breakage and heat stability for most applications. When this material does not have sufficient properties for a given application, special materials must be used. For applications where lubrication is poor, or certain corrosive conditions exist, bronze rings are frequently used. The bronze rings have very definite temperature limitations. For applications where a higher strength material is required, a malleable iron such as AMS-7311 or

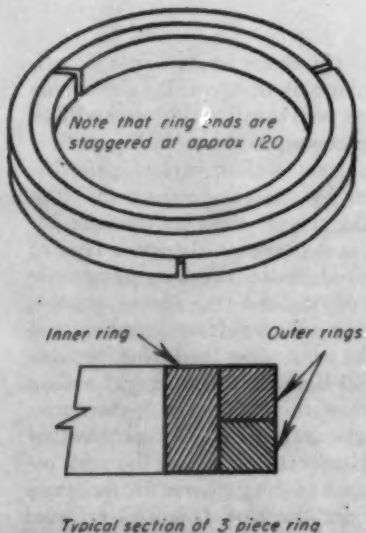


FIG. 3. Three-piece ring

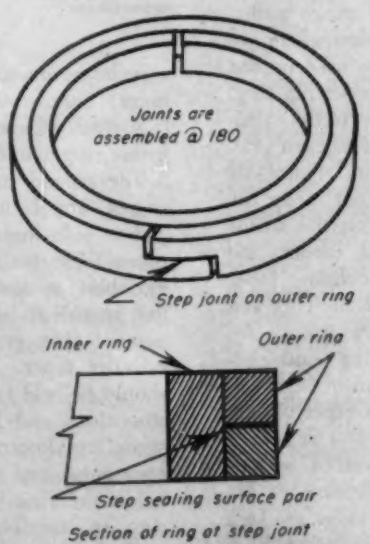

Joints are assembled @ 180
Step joint on outer ring
Inner ring
Outer ring
Step sealing surface pair
Section of ring at step joint

FIG. 4. Two-piece sealing ring

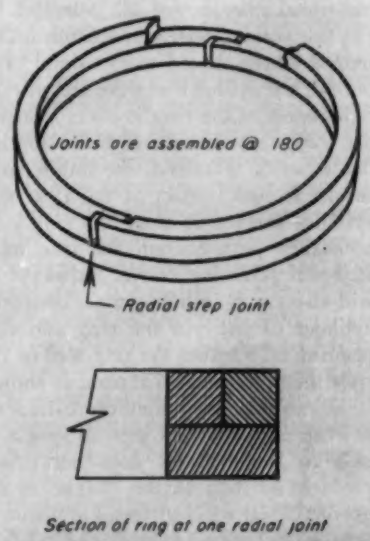


FIG. 5. Radial joint sealing ring

7312 is sometimes used. For high temperature applications, stainless steel, Ni-Resist or a high chromium cast iron is indicated.

Figure 6 shows heat stability curves for some of these materials. The heat stability tests are made by closing a ring in a cylinder and holding it at the indicated temperature for a period of two hours. The loss in tension and loss in gap are a measure of how much the ring has relaxed under the temperature and stress condition in the cylinder.

It is, of course, highly desirable to keep the number of special ring materials at a minimum since it is very costly to make small numbers of rings from a special material.

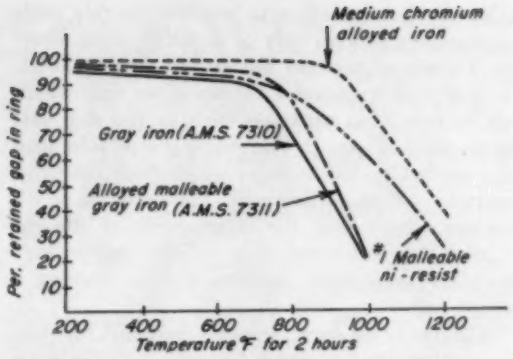


FIG. 6. Heat stability curves for selling ring materials at approximately 40,000 psi stress level.

FACTORS AFFECTING SEALING ABILITY

Numerous variations of piston ring joints and multi-piece rings are manufactured. Many of these variations are made to take advantage of manufacturing methods which the individual manufacturer considers to be most economical. The designs described in this article represent those commonly used and felt to be rather basic sealing ring designs. All of these designs will produce efficient hydraulic seals if the ring, piston and cylinder dimensions are carefully controlled.

To examine how the dimensional variations and surface finishes affect leakage, it is best to return to the step seal ring and determine what is necessary to insure minimum leakage paths between the three important sealing surface pairs. The first pair described involved surface contact between the OD of the sealing ring and the cylinder. Any non-uniformity in either surface such as scratches, tool marks, wavyness from grinding chatter, or any abrupt dimensional change are all potential leakage paths. For this reason, relatively smooth finishes which are free of heavy thread marks should be used on the bore of the cylinder and the OD of the sealing ring. Squareness of the ring grooves relative to the cylinder wall is a very critical dimension if efficient sealing is to be obtained. Deviation from squareness results in line contact of the ring either along the cylinder surface or along the ring land; this forms a leakage path around the ring and renders the step seal joint ineffective. Excessive cylinder taper will also result in line contact between the ring and cylinder or between the ring and ring groove depending on whether the ring wall or ring width controls the pressure equilibrium as shown in Figure 7. It is recommended that the cylinder taper should not exceed .0003″ per inch of length. Out of roundness of the cylinder does not present a serious problem so long as the change in dimensions are gradual. The walls of metallic piston rings are kept thin enough to be flexible and conform to cylinder out-of-roundness, but in those applications where

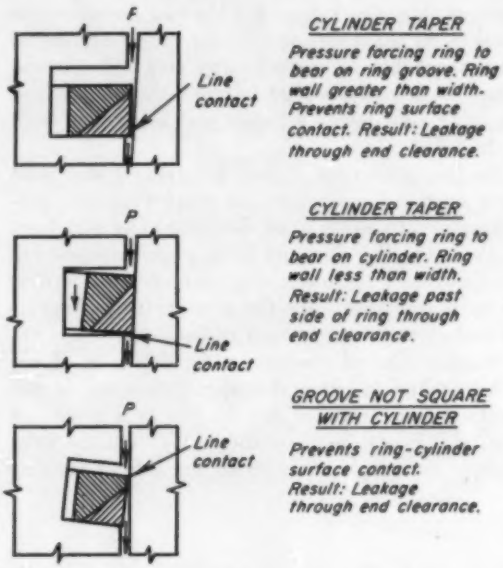

F
Line contact
CYLINDER TAPER
Pressure forcing ring to bear on ring groove. Ring wall greater than width. Prevents ring surface contact. Result: Leakage through end clearance.
P
Line contact
CYLINDER TAPER
Pressure forcing ring to bear on cylinder. Ring wall less than width. Result: Leakage past side of ring through end clearance.
P
Line contact
GROOVE NOT SQUARE WITH CYLINDER
Prevents ring-cylinder surface contact. Result: Leakage through end clearance.

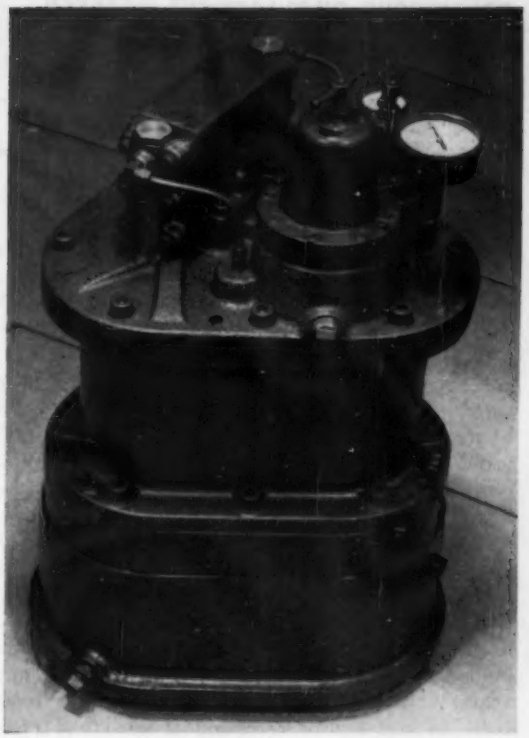
FIG. 7. Effects of cylinder taper and ring groove squareness

very large amounts (in excess of .002 in a 6″ cylinder) out-of-roundness is problem. It is desirable to use a flexible ring with a coil spring expander to insure ring-cylinder contact as shown in Figure 8.

The second important sealing surface pair discussed was formed by contact between the ring groove side and the side of the ring. Sealing between these surfaces depends on the same type of variables as described in the previous paragraph, that is, side finish of ring and ring groove, squareness of ring grooves, chatter from grinding and cylinder taper. The ring sides and ring grooves should be held to 40 RMS max. for general sealing conditions and below this value for higher pressures and lower viscosity fluids. The problem of squareness and cylinder taper affects the seal between the ring side and ring groove in the same way as described for the ring face and cylinder wall.

Continued on page 120

A new two piston power unit, which can be used as a pump or booster on water or oil systems to 2500 psi, is the result of development work on a paint pumping unit. What type of pump would you use to keep hot paint moving at high pressure? Paint has no lubricating value; it is really rough on seals, and when it dries in the pump . . . These problems plus others were solved by this new pump design.



Design of a . . .

CONTINUOUS DISPLACEMENT BOOSTER PUMP

• By Eric Nord and Elmer F. Heiser

VERY often progress in one field results in new equipment which is appropriate in other fields. In this case the pump which was developed to meet the adverse conditions encountered in airless spray painting is uniquely suited for the industrial hydraulic field as a heavy duty air operated pump, booster or intensifier.

Spraying paint, until recently, has been merely a matter of getting the paint up to a nozzle where it can be blasted off by a high speed air jet. The air jet atomizes the paint and propells it in a general direction. After serving these functions, the atomizing air becomes a costly liability. It travels with the paint to the target surface and rebounds carrying with it a large amount of atomized paint. Many attempts have been made to eliminate the need for atomizing air by spraying paint hydraulically at high pressures. It was never possible to properly atomize by this method until Bede Products, Cleveland demonstrated that paint, heated to the correct temperature and then hydraulically sprayed, gave the desired atomization and finish.

Airless Spray Painting, as this process has come to be called, has many obvious advantages such as substantial paint savings, heavier films per pass, minimum booth costs and better working conditions. Despite these many advantages, the process never became widely used because of equipment inadequacies. A pump and a spray nozzle had to be developed which could withstand the abrasive pigments and also the hot solvents encountered in most paints. Sapphire spray nozzles solved one of the problems. The other problem called for a pump

ERIC NORD, *U. S. Automatic Corp. Amherst, Ohio,* ELMER F. HEISER, *S. G. Morris Co., Cleveland.*

which would meet these conditions;

1. The pump had to be capable of handling abrasive material.
2. The discharge pressure had to be free of surges or snap fluctuations.
3. The discharge volume had to be variable from 0 to maximum flow without pressure drop.
4. The pump had to be capable of handling paints at temperatures ranging up to 400° F.
5. The pump had to be designed so it could prime as well as purge the system. This meant that the pump had to be capable of pumping air.

Rotary type constant displacement pumps have several inherent disadvantages which make them impractical for pumping abrasive materials. Pumps which depend on resilient rotors, stators, or diaphragms would require a material which would be highly resilient and also capable of long life in contact with hot paint solvents. None of the materials known today combine these two features to the required degree. Only the piston type pump seems to have the basic features which could be developed to meet the above requirements. Air operated piston pumps, Figure 1, have been used for paint for many years; however, as the displacement plunger must come to rest before reversing at each end of a stroke, considerable pressure fluctuation results. Pulse eliminators (accumulators) were tried without too much success. The bag type accumulator could not be used because no suitable elastic material was available. The piston type accumulator was impractical for use with hot paint due to the abrasive materials and the hot solvents. The atmospheric air dome is the only type of accumulator which could be used in this service. This type of accumulator was found to be impractical because at 600 psi. the air was compressed to one-fortieth of the original dome volume; the balance of the accumulator being filled with paint.

Very early in the pump development program, constant running or driven pumps were ruled out because of the severe wear and the necessity for a spring loaded pressure relief valve. It was decided that a basic pump unit as shown in Figure 2 would have the best chance of meeting all of the requirements. This unit could have a relatively large ram area which would allow slow operation speeds. It would also narrow the packing problem to one set of packings in contact with the paint as shown at A. A separation chamber was provided at B so that any paint seepage past packings would be washed off by a pool of solvent before the paint could harden on the ram and damage the packings or the ram bearing. The lower side of the air piston was floated on constant low pressure air to provide ram return and suction.

It only remained to utilize the basic piston in the ram unit in such a way that a continuous displacement, free of fluctuation, would result. This was accomplished by combining two of the units

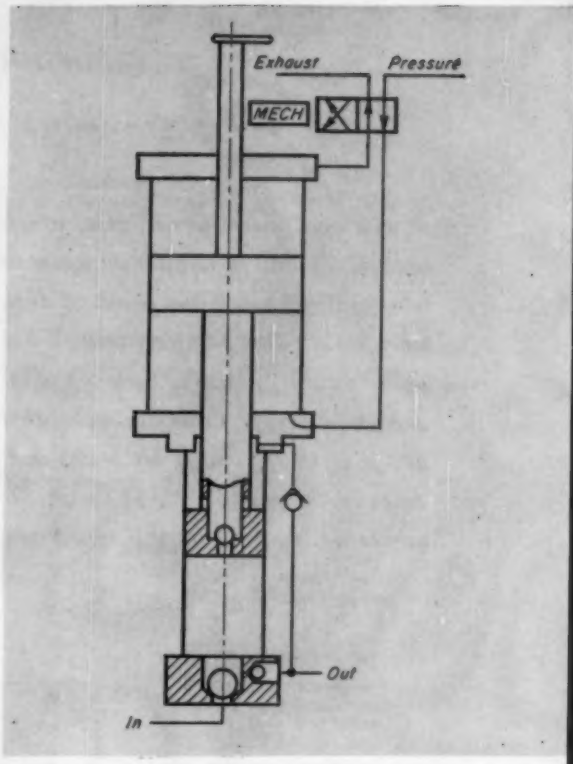


FIG. 1. PRESSURE fluctuations result when this single piston is used.

into a single pump Figure 3 with a valve arrangement which would provide overlapping action. The valve is so arranged that each ram on its downward displacement stroke starts the opposite ram downward on a pumping stroke before it reaches its own reversal point. The opposite ram starts and brings its ram chamber up to pressure before the initiating ram returns. Thus one ram is always pumping and for a brief interval in each cycle both rams are displacing fluid.

The finished pump, shown in the photograph, is ruggedly built. The air control valve unit mounts as a complete package on the top of the pump. The pump has been intentionally over-built as to size and capacity in order to provide slow continuous operation under very adverse conditions. Ample safety factors are designed into the pump to allow its use with minor modification on water or oil applications up to 2500 psi. It is designed to take the high cycling speeds during priming or purging operations. The combination of all of these features makes it a very useful piece of hydraulic equipment outside of the paint industry.

This unit is being incorporated into several hydraulic press systems as a water or oil pressure booster. It would be particularly useful for hydrostatic testing, clamping, loading or wherever an efficient heavy duty unit is required. ▼▼▼

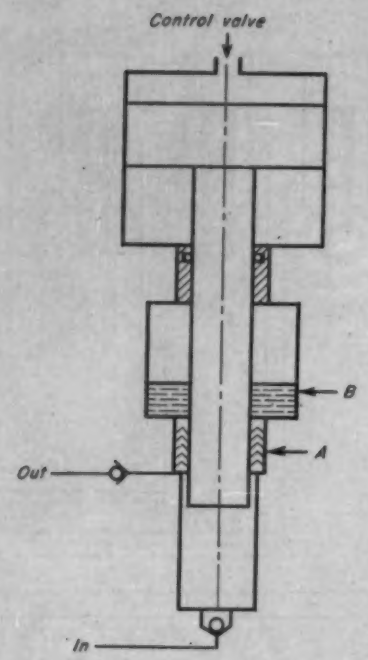


FIG. 2. PACKINGS "A" are the only set which comes in contact with the paint. "B" holds a solvent to prevent hardening of any paint seepage.

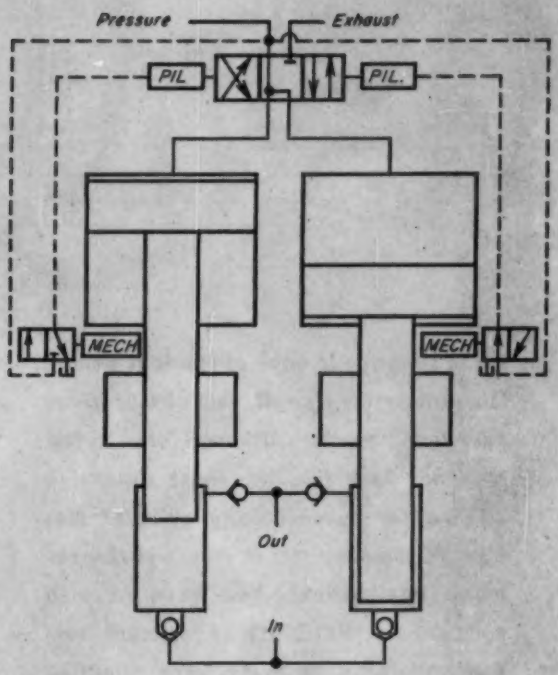
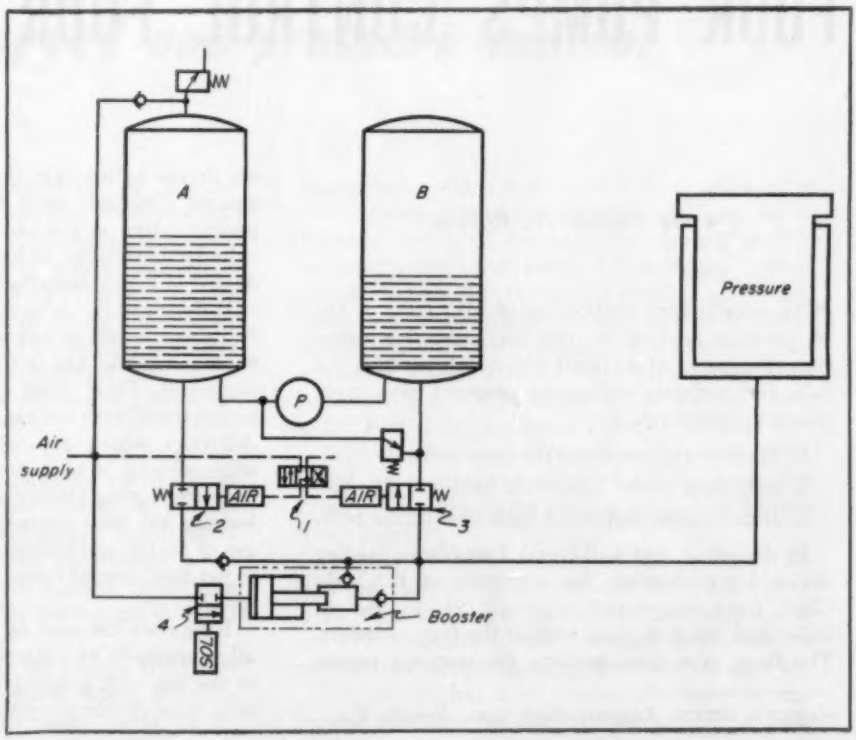
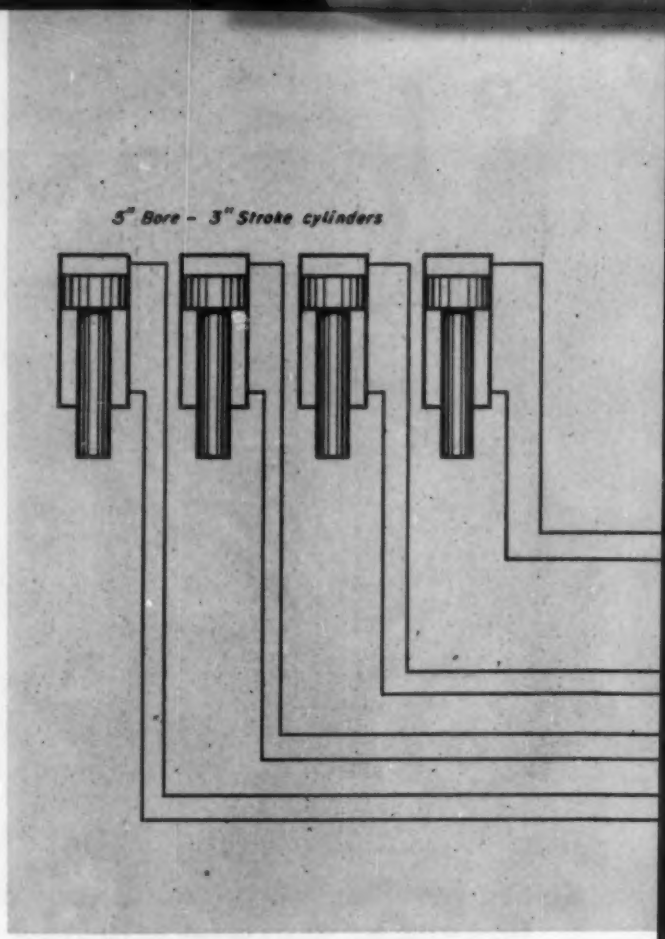


FIG. 3. FINAL BOOSTER design uses two pistons with a valve arrangement which provides overlapping action.

FIG. 4. A PRESS requiring high pressure and low volume when closed is an excellent application for a booster. In this circuit, the press is closed by low pressure fluid supplied under air pressure from bottle A through valve 2. With the press closed, the booster goes into action. To open the press, valve 3 is opened permitting fluid flow from the gravity lowered press to enter bottle B. Transfer pump P then moves fluid from B to A.





If the slippage in each of the four pumps is equal or very small, this circuit gives excellent results. Although this setup may not look like the least expensive method for synchronizing cylinder motion, in the long run it may well be for many applications. You have to also consider the flexibility of pressure control and the duty cycle when selecting this circuit.

FOUR PUMPS CONTROL FOUR CYLINDERS

• By Harold V. Rutkus

ONE widely used application of hydraulics is the pressure loading of rolls for embossing materials. Designers of a circuit which will position the rolls and maintain embossing pressure have three primary considerations:

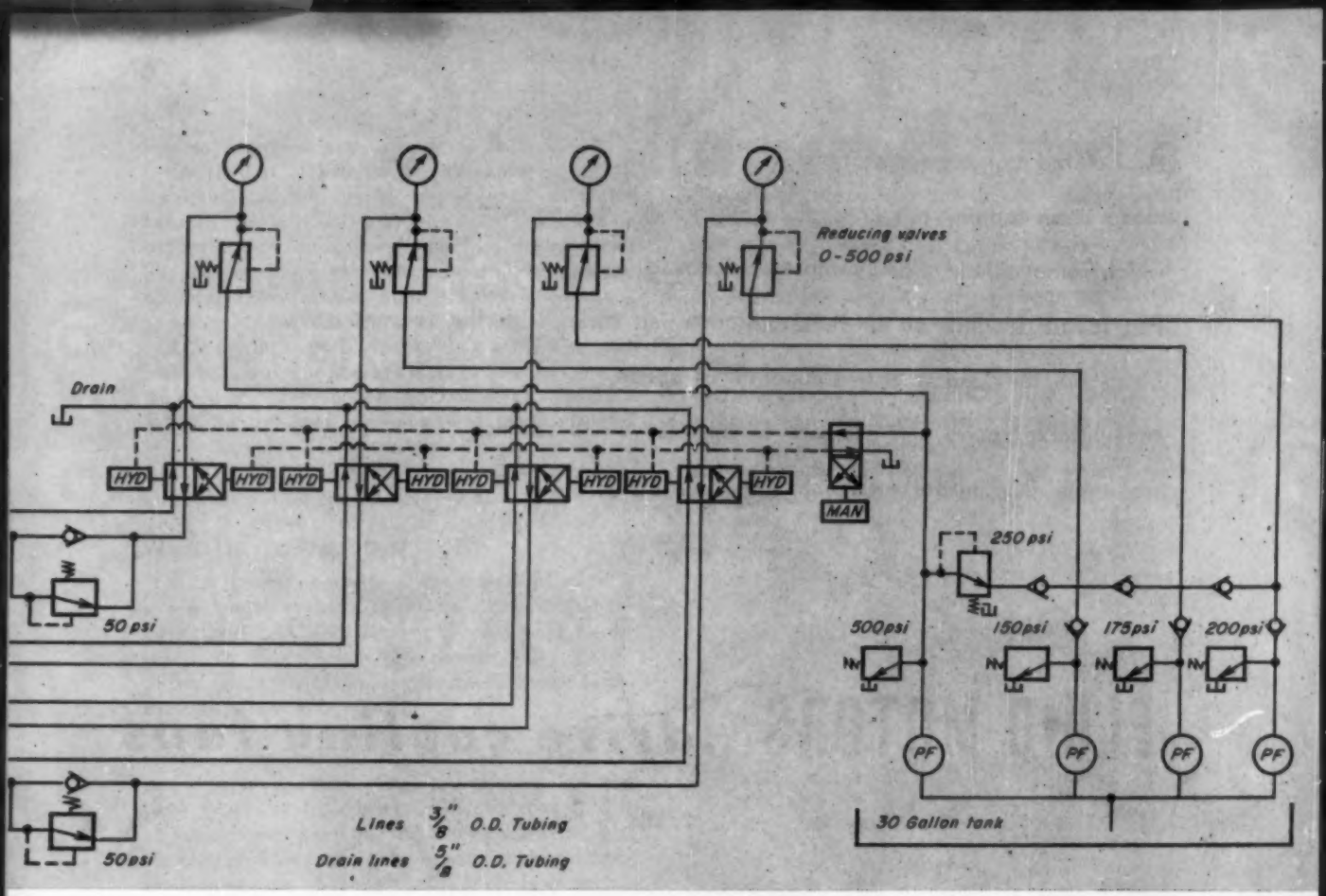
1. flexible and accurate pressure control
2. minimum power loss while holding
3. simultaneous motion of both ends of the rolls.

In designing and building a four-piston loading device for embossing, the engineers at Kimberly Clark Corp., developed a circuit which uses an individual pump to close each of the four cylinders. The four, vane type, positive displacement pumps are driven by a single, double-shafted motor which assures identical speed for each pump. With all pumps driven at the same speed, delivery to each cylinder is so close to being equal that the desired degree of synchronization is easily obtained.

Differences in delivery to each cylinder could be caused by variations in leakage in the lines, unequal pump slip, and initial differences in pump displacement. These three possibilities for inaccurate piston travel have not caused trouble. Pumps having deliveries which are very close were originally selected; slip is at a minimum because operating pressure during closing is less than 100 psi; and leakage has been controlled by careful layout and use of tubing and fittings. It has not been necessary to put flow control valves in the lines to synchronize speed.

How does the cost of this circuit compare with other methods of control—for example, compared to the use of a single pump or hi-lo pump circuit with flow dividers? Since this particular machine

HAROLD V. RUTKUS, *Kimberly Clark Corp., Neenah, Wis.*



. . . to assure speed and pressure control

has very small delivery requirements—1 gpm for each cylinder—the four pumps are small, low cost units. Because of the small size pumps, the cost of this circuit compares favorably with a hi-lo circuit and flow dividers. Also, for this particular machine, this circuit is practical because during the holding operation, low pressure from three of the pumps provide power to auxiliary equipment. This equipment only operates when the embossing pistons are down.

Pressure settings of the relief valves at the pumps are such that each pump supplies its own cylinder and moves the piston until the end of the stroke. Arrangement of the check valves and relief valves at the pumps is made to isolate each pump to the work cylinder it supplies, until holding pressure is reached. This is the reason for having the different relief valve settings.

The pressure settings of all the pumps are above that required to move the pistons. Rising pressure in cylinder 1 at the end of its stroke opens the sequence valve which is set at 250 psi to allow oil to flow into the header which supplies all cylinders. Pressure rises in the header to the setting of the 500 psi relief valve which limits the maximum holding pressure for all cylinders and is supplied by the first pump only. During holding, the other three pumps dump to tank or power auxiliary equipment at their respective lower settings. This arrangement cuts power to ¾ hp. With all pumps at 500 psi power would be 1½ hp, the excess resulting in heat.

Directional control of the four cylinders is obtained by manual operation of the ¼ inch pilot valve which controls the position of all four ⅜ inch 4-way valves.

Pressure on each roll can be independently adjusted by regulating the pressure reducing valves.

Two counterbalance valves, set for 50 psi are in rod end lines of the outer cylinders to prevent the pistons from dropping when the system is shut off.

This circuit has been successfully used on embossing machines for over five years. ▼▼▼

At isolated compressor stations
along cross-country gas lines, fluid motors are driving fans
which remove heat from compressor cooling water.
Fan speed depends on air temperature which varies with the seasons.
Since the fan load is also a function of speed,
the variable speed and pressure obtainable with hydraulics
make the fluid motor an ideal drive.

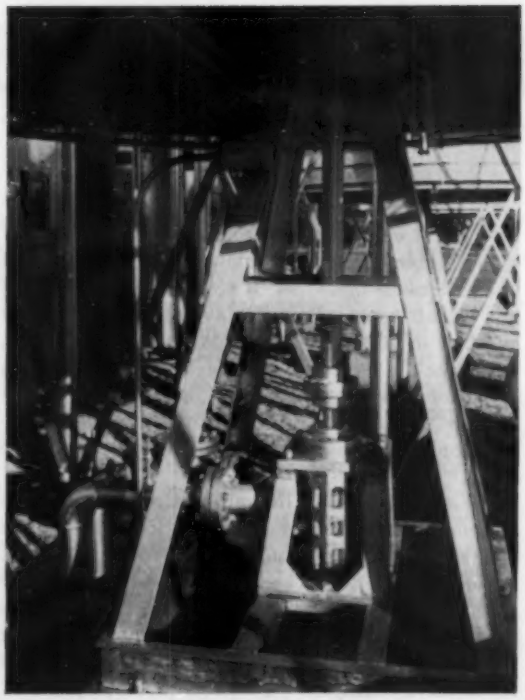
FLUID MOTORS...*drive cooling fans*

• By C. R. Taylor

IN gas line compressor stations, the auxiliary equipment which contributes most to operating cost and requires the greatest horsepower demand is the fan on the water cooler. Installation of variable speed fluid motor drives on these fans result in a considerable savings in horsepower, provides automatic temperature control of cooling water, and provides self lubrication. Fans can be mounted directly on the motor shaft, which is in a vertical mounting stand. This direct fan drive eliminates gear reducers and their maintenance.

Fluid flow and pressure are regulated by a temperature control which monitors the temperature of the water. A diaphragm-operated flow control valve actuated by a temperature controller maintains a constant water temperature by bypassing part of the pump output to tank. This varies the fan speed for any given ambient air temperature. Since fan speed determines the load, varying the speed also varies the system pressure. For instance when the temperature controller calls for less speed, the flow control valve opens and reduces the oil flow to the fluid motor. At the lower fan speed the fan

C. R. TAYLOR, *Manager of Sales Engineering, Berry Div., Oliver Iron & Steel Corp.*



FLUID MOTOR is in a vertical mounting stand. The fan, mounted on top of the tripod, is coupled to the motor through the flexible coupling.

load is decreased and pressure is reduced.

The hydraulic systems are designed to obtain maximum fan horsepower and speed at pressures between 300 and 400 psi. This ensures the lowest capital investment because standard pipe and series 30 fittings can be used throughout. Low pressure operation also ensures high volumetric efficiency at normal fan speeds and prolongs unit life.

A heavy duty grade of crankcase oil is used and includes anti-foam and anti-rust inhibitors. Viscosity is in the range of 400 SSU at 100 F (SAE 20 WT). Natural heat transmission from the system piping balances out operating oil temperatures to approximately 130 F. No coolers have been required on any of the systems installed.

FLUID MOTOR DESIGN

With the requirements of the system in mind it was necessary to find a hydraulic unit which would meet these and also develop the required horsepower at relatively low fan speeds. The rotary-piston, positive-displacement hydraulic motor meets these requirements.

These units are precision built with controlled clearances, and all rotating parts are mounted on anti-friction bearings. Capillary sealing between parts results in high mechanical efficiency at low operating speeds, and maximum torque is developed on starting. This sealing also ensures high efficiency for long periods of time, because there is no metal-to-metal contact or rubbing surfaces.

The smooth torque output and pulsationless flow of this fluid motor make it an excellent fan drive unit. Case pressure equalizes at about 60% of the operating pressure. This case pressure acting on the drive shaft offsets the thrust imposed by the fan and actually unloads the main thrust bearing when the unit is directly driving a fan. The main bearing, however, is designed for acceptable life when taking full thrust from a 14-foot fan.

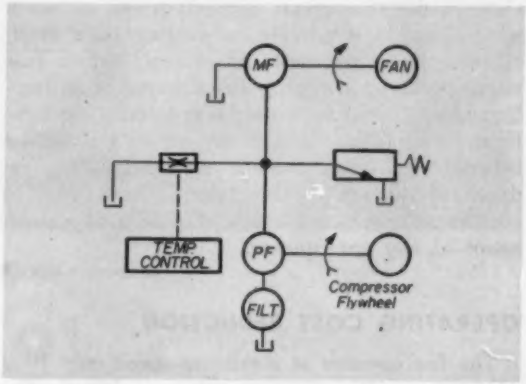
A considerable number of main-line compressor stations are equipped with hydraulic drives where additional auxiliary equipment such as the turbine-type water pumps are also powered from the main hydraulic system. The stacking feature of the rotary piston unit is ideally suited for these multiple service applications. The unit is built in sections. These can be either manifolded together for a parallel delivery, or each section can drive a separate hydraulic motor with each system at a different pressure.

MOUNTING

The fan is mounted either directly to the hydraulic motor or through a flexible coupling when a tripod structure is used. The pump is either directly driven by a shaft from the compressor flywheel or is belt driven. This depends on the horsepower requirements of the fan and the space available.

Where a number of compressors are to be serviced, it is sometimes expedient to install an inlet header for all pumps rather than individual tanks. This depends on station operation and whether all compressors are to be permanent or semi-portable. The inlet header is usually constructed of 8 to 12-inch pipe to lower oil velocity at the pump inlet. The header can be installed the length of the building as a reservoir for a multiple pump installation. The discharge header can be installed in the same manner.

Extreme care is taken during installation of the hydraulic system to ensure that piping is free of mill scale and foreign material. The piping is chemically cleaned, or pipe spools are substituted for the hydraulic units and kerosene or fuel oil is circulated through the piping and filter until all dirt is removed.



TEMPERATURE CONTROL monitors temperature of cooling water and regulates bypass valve to govern fan speed.

AUTOMATIC TEMPERATURE CONTROL

Precise, automatic control of jacket water temperature is an important advantage variable of fan speed. Constant water temperature increases the compressor operating efficiency and lowers operating costs by reducing downtime. Even with extreme variations in ambient air temperature, ±1-degree control of water is obtainable. Automatic temperature control facilitates design of unattended stations. One of the large gas companies is presently operating up to 8000 horsepower in main-line compressor service with one man in attendance. The same company's 2640-hp booster station operates unattended 16 hours a day.

ADVANTAGES OF FLUID MOTOR DRIVE

Integrating the compressor with its auxiliaries facilitates removal of a compressor unit without interrupting station service when the gas supply in one particular area is depleted and the compressor is needed at another location.

In isolated compressor stations, hydraulic drives are particularly expedient. Usually the cost of running electric power to these stations is prohibitive, and a hydraulic drive eliminates the erection and

expense of an additional building to house electric generating equipment.

The non-hazardous characteristics of the fluid system installed in the compressor building are important considering the vapors present. Another bonus from the hydraulic drive is that maximum water rate is maintained through the cooling coils. In cold weather operation this prevents frozen coils resulting from a water by-pass system where low water velocity through the coils permits freezing.

The fluid system permits separating the cooling radiator from the engine and compressor on portable or skid-mounted units. This prevents re-cycling of hot air when the cooling device is located too close to the compressor take-off drives, or when wind direction is adverse for cooling on a short-coupled, integrated unit. At present 16-foot fans requiring 40 hp are being direct driven by hydraulic motors. Higher fan horsepower installations have been accomplished through the use of a reduction between the hydraulic motor and the fan. The hydraulically driven cooling systems have been in continuous operation for 4½ years without maintenance of any consequence.

OPERATING COST REDUCTION

The fan operates at maximum speed only 10% of the time when air temperature is 100 F. The direct savings in operating expense resulting from the installation of a variable speed hydraulic drive can evaluated.

Overall efficiencies of the hydraulic system range between 75% and 80% depending on speeds and horsepowers developed. Studies show that for a year period actual fan horsepower demand is approximately 50% of maximum. This will vary slightly with different geographical locations. At $60 operating cost per horsepower per year, installation of a variable speed drive on a 30-hp fan results in a savings of $900 per year per fan. As there is usually from 3 to 10 fans per compressor station, savings are considerable over a 10-year operating period.

In comparing costs between two identical stations regarding compressor horsepower installed and fan horsepower required, the following data was obtained. At the station where cooling fans operated at a contsant speed and water temperature was controlled through a bypass valve on the jacket water system, the electric power costs were $2200 per month. At the station where the fans were converted to variable speed hydraulic drive, and power was taken from six 1000-hp compressors, the electric power cost was $350 per month.

The fans consume only that horsepower which is required for cooling at any given ambient air temperature. The demand on compressor horsepower

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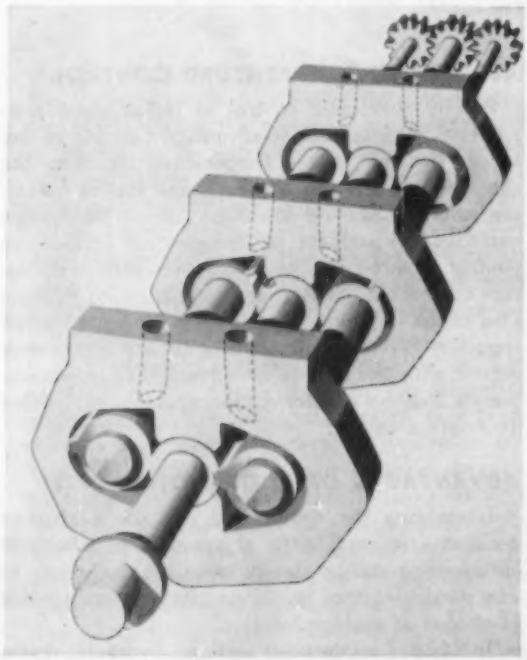


PUMP-MOTOR INTERIOR shows stacking arrangement of piston "places". This permits one pump to supply various pressures for different fluid circuits.

ALL THREE ROTATING MEMBERS (P_1, V, P_2) are geared together in a 1:1 ratio. There is no metallic contact of rotating members with the housing. The oil film seals the unit. Virtually pulsationless operation is assured.

NO SEALING CONTACT is required while the piston P_2 passes the bucket of V, since the pressure is equalized around P_2. Center member, V, is a rolling seal, with a rolling line of contact alternately with each piston.

THE SIMPLICITY OF DESIGN permits a rugged construction that gives long life with minimum maintenance. This design also assures equal performance in either direction of rotation for either pump or motor.

THE SMALL RADIUS of gyration of the pistons produces a low inertia effect, and gives maximum torque. This characteristic lends itself readily to those applications requiring rapid acceleration or deceleration.

Photos Courtesy The Detroit News

OIL HYDRAULICS is used to maneuver the dredge and to dig out the sand.

SERIES CONNECTED FLUID MOTORS

...power winch and cutter on dredge

In Michigan, they're trying hard to live up to their "water wonderland" slogan. Swamps are being converted to play areas. Much technical know-how is going into this conversion project.

IT takes a lot of power to dredge out a lake. What's the best way to produce this power? The answer, of course, is hydraulics. Old time dredges which used cumbersome mechanical drives made up of giant pulleys, drums, and bull gears are on the way out. Hydraulic drives which now do the job are small compact packages which are safer and much easier to operate.

Last year, the J. T. Poupore Co., Detroit contractors and engineers, built a portable dredge and they are being kept busy working with the Michigan conservation department. After 10 weeks building the dredge, it was transported to the lake and assembled in four days. Power for all functions except the mud pump is supplied by a 70 hp diesel unit. This powers the oil hydraulic system which powers the cutter and winch.

The dredge can dig 18 feet deep. It moves in a 100 foot arc and walks forward at the end of each arc by raising and lowering pointed spuds built into the hoist at the stern of the machine.

Design of the hydraulic circuit was made by J. N.

SERIES CONNECTED MOTORS

Fauver Co., Inc. The circuit drawing shows the use of 2000 psi fluid motors connected in series. Use of this pressure permits the use of series motors and makes it possible to design a much simpler circuit than would be required if parallel connected motors were used.

The winch motor feeds shore and anchor cable in and out, raises and lowers the cutter to adjust for depth of cut, and raises and lowers the spuds which act as the pivots about which the dredge walks. None of these operations are performed simultaneously. A mechanical clutching arrangement is used to connect and disconnect each operation.

The pump, driven at 1300 rpm delivers about 41 gpm at 2000 psi. At this pressure it draws about 53 horsepower from the diesel engine.

MOTOR TORQUE CONTROL

Maximum pressure and torque at each motor is adjustable at the relief valves. For most conditions, the winch motor operates with a pressure drop of 700 psi, and the cutter motor operates at 1100 psi. Winch motor speed is varied between 750 and 1500 rpm by use of the 0-20 gpm bleed-off flow control valve. Output torque at 700 psi is about 600 lb-in. Since this motor need not be reversible, a directional control valve is not needed.

The cutter motor develops about 1600 lb-in of torque and operates at a speed close to 800 rpm.

Direction of the motor is controlled by the manually operated three position 4-way valve. This valve has an integral 2-way valve which is positioned to vent the relief valve when the cutter is stopped. With the cutter stopped, total pump pressure is available to the winch motor.

FLOW DIVIDER IS UNNECESSARY

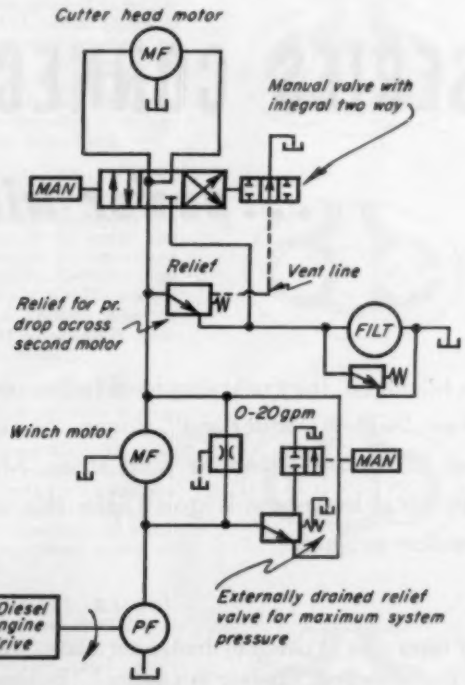
In this circuit it is necessary to have an external drain in the spring chamber of the first relief valve to prevent pressure buildup in the spring chamber.

With the motors in series, a flow dividing mechanism is not necessary to maintain steady smooth operation. Fluctuation of oil delivery is eliminated.

The first motor is easily controlled from a remote position by running a small pilot line to the manually operated vent valve.

Proportion of power consumed by each motor may be easily varied by adjusting the second relief valve, always allowing the cutter motor to consume whatever power is not used by the winch motor.

How much work does this dredge do? An average of 1400 cubic yards of sand are pumped out in eight hours. ▼▼▼



HYDRAULIC circuit for winch and cutter.

FLUID MOTOR drives the cutter through a gear box and chain drive.

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with HYDRAULIC PERFORMANCE

Gradall's smooth power enables it to accurately grade ditches for drainage.

3 PUMPS

deliver independently

This heavy-duty "Commercial" triple hydraulic pump generates fluid power in abundance to operate the tools of the multi-functional Gradall. No other kind of power transmission could successfully furnish power required to dig tough materials like shale; at the same time furnishing smooth precision-controlled down pressure on the tool, a feature inherent in this multi-purpose machine.

Three separate fluid power pumps are assembled into a single unit, all driven by one through shaft to which the primary driving power is applied. It is not unusual for these pumps to operate at pressures up to 1200 psi. Total discharge of about 95 gpm at 1500 rpm could be developed, with the first and second pumps each delivering 40 gpm to power the cylinders actuating the boom and the third pump supplying about 15 gpm to the cylinder which positions the tool.

"Commercial" gear type fluid power pumps are heavy-duty—designed and built for one main objective: troublefree service over a long life expectancy. Many original equipment manufacturers today are using "Commercial" pumps because they perform better, require less servicing, and have proven that they save money. The Commercial Shearing and Stamping Company, Youngstown, Ohio; Chicago, Illinois; Salt Lake City, Utah.

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KA-70

Is the cost of fire-resistant hydraulic fluids too high for economical use in die casting machines? "No", say these die casters, who have developed an efficient method of . . .

RECLAIMING FIRE-RESISTANT FLUIDS

WHAT is the difference in operating cost between a fire-resistant hydraulic fluid and a petroleum base fluid?

This is a question that more and more metal molding plant managers are asking as they consider switching to fire-resistant fluids. For in spite of the demonstrated value of such a fluid where there is a danger of fire, an understandable reluctance to change to a higher priced fluid exists in these days of keen competition and economy.

Nevertheless, many managements are making the change, and undoubtedly many more will, as the expanding use of hydraulics pushes harder against the limits of petroleum base fluids. A fire-resistant fluid is consistent with industry's long-time effort to increase job safety and improve production efficiency. There is evidence, too, that as the use of such fluids becomes widespread actuarial findings will point to a reduction in insurance rates.

At any rate, the answer to the question, in many instances, has been that the difference in real cost between a fire-resistant fluid and a petroleum base fluid is surprisingly small. If it is not exactly a case of having their cake and eating it, too, most plant managements are pleased to learn that with a little extra care and investment, it is possible to reduce new fluid requirements to the point where make up costs are comparable with oil. Both leakage control and reclaiming are necessary.

How the single factor of fluid reclamation affects the real cost of synthetic fire-resistant fluids is illustrated by the experience of Hardy Manufacturing Company, Union City, Indiana.

One of the largest companies in the highly competitive automotive parts field, Hardy tried Pydraul F-9* in mid-1953 at the suggestion of their insurance underwriters after several fires which only quick action prevented from doing great damage.

In August, 1953, when the company activities were consolidated in new quarters at Union City, the synthetic fluid was installed in all of its die casting machines.

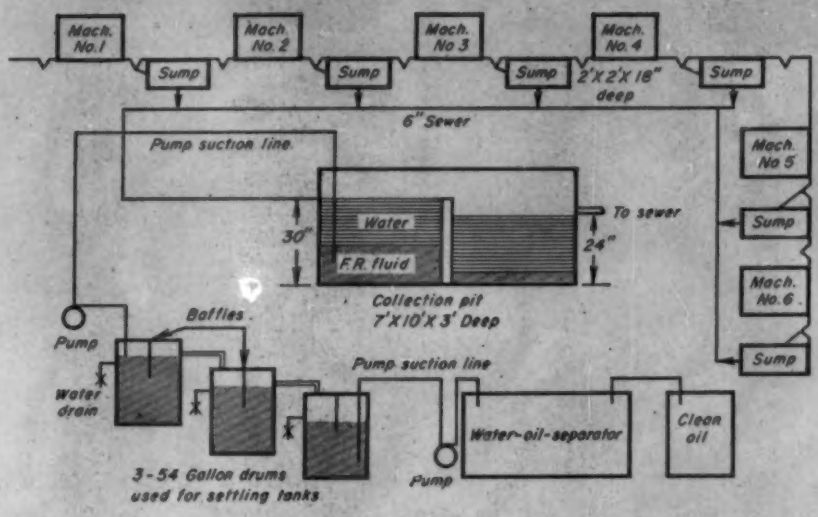
In the first year, total new fluid requirements was one drum a week compared with four drums a week the previous year.

**Reclamation procedures described here are reported to be equally effective with other synthetic, fire-resistant fluids such as tricresyl phosphate and chlorinated biphenyl.*

AUTOMOTIVE die castings, such as horn rings and parking lamp housings, are being die cast in zinc in this plant.

TWO BOTTLES show the results of reclamation. The one on the right contains dirty fluid, the one on the left is reclaimed fluid.

This simple reclaiming system cost about $500



Here is how the record looks on a per machine basis for the two periods: About 1,781 gallons of new fluid per machine at a cost of approximately $979 when using oil and 468 gallons at a cost of about $1,500 with fire-resistant fluid. The result is that a fire-resistant fluid priced at about 6½ times the conventional fluid is actually costing less than twice as much.

Hardy's simple reclaiming system consists of collecting trenches and lines leading to a settling and filtering train. The total cost was about $500.

The trenches around the bases of the machines carry spilled cooling water and fluid lost through line breaks or spills, to one of six sumps from which it flows underground to a 25-barrel collection pit. Here the water and hydraulic fluid are allowed to separate, and the fluid is pumped to a gravity settling train consisting of three 55-gallon drums. A two-stage activated clay filter removes the last traces of impurities and water, and the fluid is ready to re-use.

According to Clay W. Riley, plant engineer, the system will perform even better as leakage is brought under tighter control and reclaiming, already 75 percent efficient, becomes more effective with addition of automatic controls and other improvements.

In addition to its primary justification—the prevention of fire—a fire-resistant fluid often results in other tangible and intangible benefits. As Ben H. Antrobus, die casting supervisor at Hardy says, "Productivity has improved considerably because of fewer interruptions and better morale."

Hardy's experience seems to confirm that where there is a danger of fire—hydraulic fluid under pressure and a source of ignition—the use of reclaimable fire-resistant fluid is inexpensive insurance. ▼▼▼

FILTER is shown, with plant engineer, Clay Riley, drawing a sample for inspection. Oil is pumped into the filter from 3 drums used as settling tanks.

METAL TEMPERATURES are held between 850 and 900 F in the holding pot of these zinc, die casting machines.

FIG. 1. AIR POWERED pusher positions bundles of newspapers into the wire tying machine.

This job called for the design of a mechanism to feed newspaper bundles to a wire tying machine. It's a straight line push—nothing at all complicated about it—an easy job for an air cylinder. There isn't any question about HOW to push, but because there is great concern about WHEN to push, the mechanism is a . . .

SIMPLE AIR DRIVEN PUSHER REQUIRING MANY ELECTRICAL CONTROLS

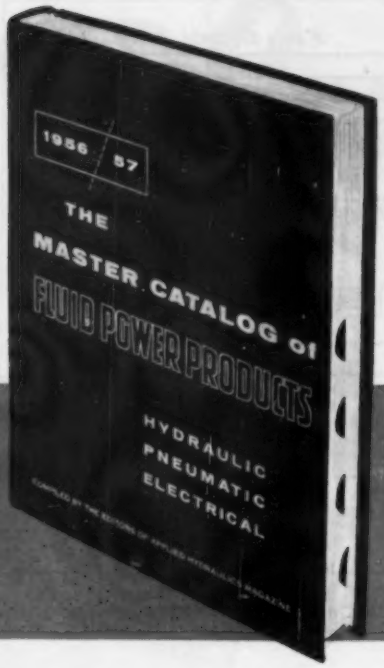
• By Robert E. Miller

BIG city newspapers have a tremendous production job. To keep pace with bigger and faster printing presses, handling equipment to move these papers out of the plant is being developed. Bundle feeding devices and wire tying machines* are using air power.

In the mailing room of a newspaper, the feeder mechanism designed by Curtis Development and Manufacturing Co. positions a stack of newspapers into a wire tying machine and, at the proper instant, the wire tying machine is automatically started by the feeder mechanism. The air powered

ROBERT E. MILLER, *Vice President, Curtis Development & Mfg. Co., Milwaukee, Wis.*

*"*Want Faster Operations? Use Air Circuits", APPLIED HYDRAULICS *March 1954. This article described the air circuitry on a high speed bundler.*



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pusher returns to normal position and the process is repeated by the succeeding stack of newspapers, which is conveyed to the feeder mechanism. The succeeding bundle is again positioned into the wire tying machine and the bundle already tied is automatically ejected by the untied bundle into a delivery chute which leads to the loading platform.

In newspaper operation, bundles of newspapers, which are delivered for local distribution, are usually tied with one wire. On bundles that are to be delivered out of the city, it is necessary to tie with two wires. Therefore, it was necessary to incorporate control features that would permit a bundle to be positioned for one tie and upon completion of the first tie, to properly position the bundle for a second tie.

The rollers of the feeder mechanism are chain driven by a ¾ horsepower, 3 phase, gear-head motor. The motor of the roller drive is controlled by a motor starter equipped with thermal over-load trips. The pusher which positions the bundles into the wire tying machine is driven by an air cylinder, which is electrically controlled. The pusher consists of a four wheel carriage of very light weight, which operates on a structural steel track.

Electrically operated solenoid valves shown in Figure 2 are controlled by means of precision limit switches. Likewise, the stroke length of the pusher and also the starting of the tying machine for both single-tie and double-tie are controlled by precision limit switches. The limit switches are actuated by adjustable cams as shown in Figure 3.

ELECTRICAL OPERATION

When a bundle of newspapers advances to the bundle stop, a limit switch picks up a relay to shut down the roller drive before the pusher begins to transfer the bundle into the tying machine. The 4-way solenoid valve is energized, causing the pusher to deliver the bundle of newspapers to the proper tying position. At proper length of stroke, a limit switch opens to reverse the 4-way solenoid valve, causing the pusher to reverse. At point of reversal, a limit switch closes momentarily to initiate operation of the wire tying machine. When the pusher returns, the roller drive is started and the feeder is ready for the next bundle. Figure 4 shows the control compartment containing the motor starter, timing relays and control relays.

Figure 5 shows the operating control panel.

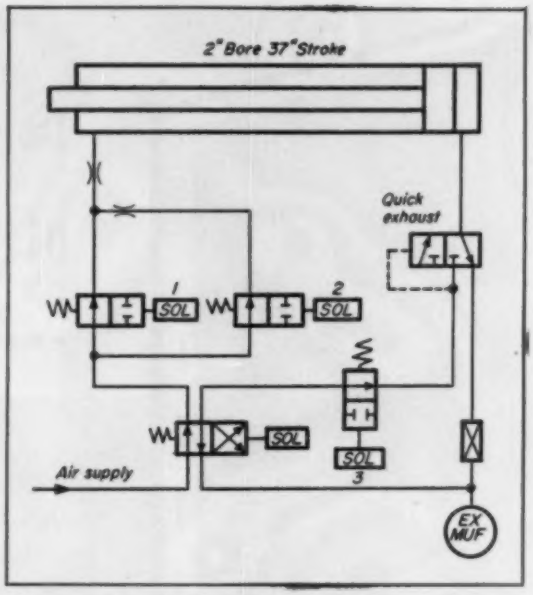

FIG. 2. PUSHER cylinder is electrically controlled to provide proper start, stop and reverse action.

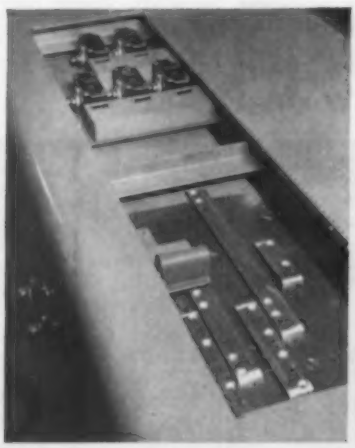

FIG. 3. BUNDLE position is controlled by cam actuated switches.

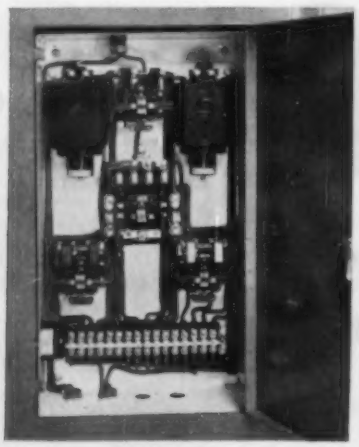

FIG. 4. PNEUMATIC TIMERS and holding relays are on this panel.

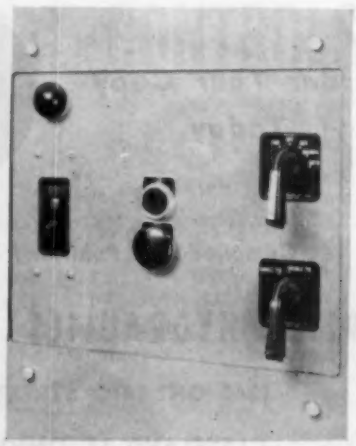

FIG. 5. OPERATOR'S controls for selecting operating cycle.

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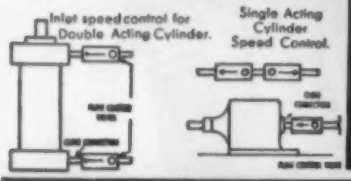

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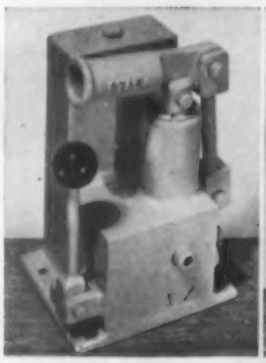

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AIR DRIVEN FEEDER

Either single-tie or double-tie, can be preselected by turning the control switch. During regular operation, the other control switch is always in the "automatic" position. If it is desired to have the pusher advance to full length of stroke for maintenance or cleaning operations, the control switch is turned to the "forward" position. The pusher will advance slowly to full length of stroke and will reverse by turning the control switch to the "reverse" position. A three pole no-fuse breaker for connecting the main power supply is also located on the control

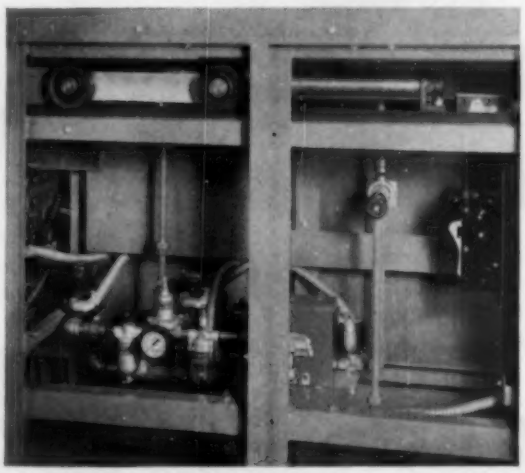


FIG. 6. AIR CYLINDER drives the roller mounted magnesium pusher. All air controls are readily accessible.

panel. When this circuit breaker is closed, the red pilot light indicates power is on. An "on-off" push-button station energizes the control circuit for the relays and the various solenoid valves. The red mushroom button is the "off" button which locks the feeder mechanism. It prevents the roller drive from starting, and prevents the pusher from moving forward, by closing solenoid valves 1, 2 and 3. Remote control can be easily wired.

If it is desired to double-tie a bundle, the control switch is turned to the "double-tie" position. The bundle advances to the stop which engages a limit switch to shut down the roller drive. The 4-way valve is energized to start the pusher. At the proper length of stroke, a limit switch picks up a pneumatic timer and relay which closes solenoid valves 1, 2 and 3, stopping the pusher for the first wire tie. At the same time, another limit switch is closed momentarily to energize a second timer and pick up a relay which initiates the tying operation. The first timer holds the pusher until the tying machine completes its cycle for the first tie. After the tying cycle is completed, this timer opens solenoid valves 2 and 3 only. The pusher advances the bundle to the second tie position, and at the proper length of stroke, a limit switch is tripped to reverse the 4-way solenoid valve, and return the pusher to its original position. At point of reversal, a limit switch initiates

the second tie. As the pusher returns, the roller drive is again started up and the feeder is again ready for the next bundle.

On the wire tying machine, a limit switch is provided to prevent operation of the feeder mechanism during wire breakage. This is important in order to avoid an untied bundle being ejected. If wire breaks, a tension arm of the tying machine drops and opens the limit switch to lock out the feeder mechanism. The roller drive is shut down and the pusher cannot advance. If the pusher is advancing forward when the wire breaks, the pusher will reverse immediately and remain in lock-out position until tension is restored.

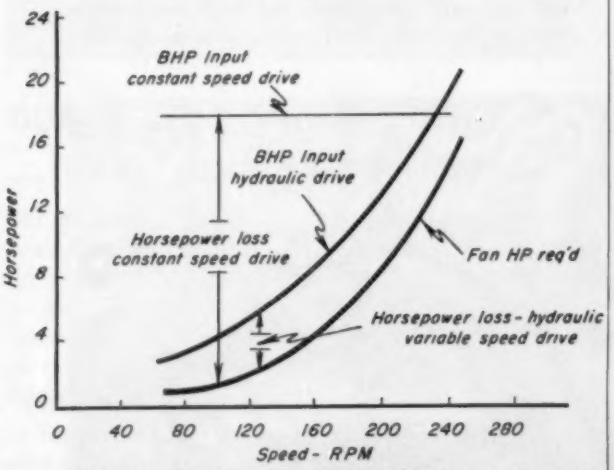
When the pusher has delivered a bundle to proper tying position, the useful work of the feeder mechanism has been performed. Therefore, it is necessary to return the pusher as quickly as possible. To reduce the weight of the pusher, magnesium was used. Furthermore, the air cylinder had to be properly cushioned so there would be no impact or hammer blow on the feeder mechanism. The light weight construction of the pusher reduced the problem of air cushioning the cylinder.

All electrical equipment is wired to terminal blocks which facilitates trouble shooting or replacement. A terminal block is provided for connecting the incoming 220-volt, 3 phase power supply. The limit switch compartment, the control compartment and the motor compartment are all designed for ready accessibility. ▼▼▼

FLUID MOTOR FAN DRIVE

Concluded from page 78

is considerably below maximum with normal ambient air temperatures. In winter when the demand on the compressor for gas transmission is the highest, the horsepower demand at the fan with a variable speed system is the lowest. During the summer months when maximum cooling is required and fan horsepower demand is at the peak, gas transmission requirements are usually lowest. ▼▼▼



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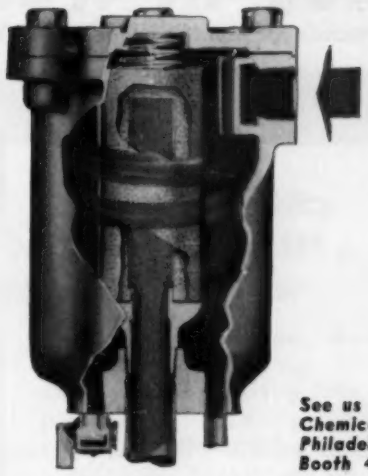

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SHEET METAL FEEDERS ARE GOING HYDRAULIC

AS the capacities of metal processing equipment become greater, the capacities of machines which feed and discharge this equipment become greater also. For example, sheet metal feeders manufactured by the Dexter Folder Company now handle loads weighing 15 tons or more. This equipment feeds sheet metal to punch presses, shears, slitters, buffing machines, cleaning lines, metal decorating lines, etc. In the near future such feeders will be available for handling plate to $\frac{3}{8}$ inch thick.

With the development of the larger feeders, new methods have been developed for lifting the load to the feeding mechanisms, the ratchet-type mechanical systems used on smaller machines not being adequate for lifting the heavier loads. Therefore, a hydraulic system has been developed which automatically lifts and indexes the load at a rate consistent with the speed of the feeding mechanisms.

Shown in Figure 1 is a typical feeder in operation, this one feeding sheet metal to a lithographing press at Inland Steel Container Company's Chicago plant. The lithographed sheet later will be formed into drums.

Figure 2 illustrates a schematic diagram of the hydraulic circuit used on a $7\frac{1}{2}$ ton capacity feeder. Power for both the "fast rise" and "automatic indexing" pumps is supplied by the 5 hp motor. In starting up, oil from the "fast rise" pump first supplies oil to the cylinder to lift the load to the feeding position. This operation is controlled by the hand operated valve. Once the load contacts the governor, Figure 3a, the hand valve is released and

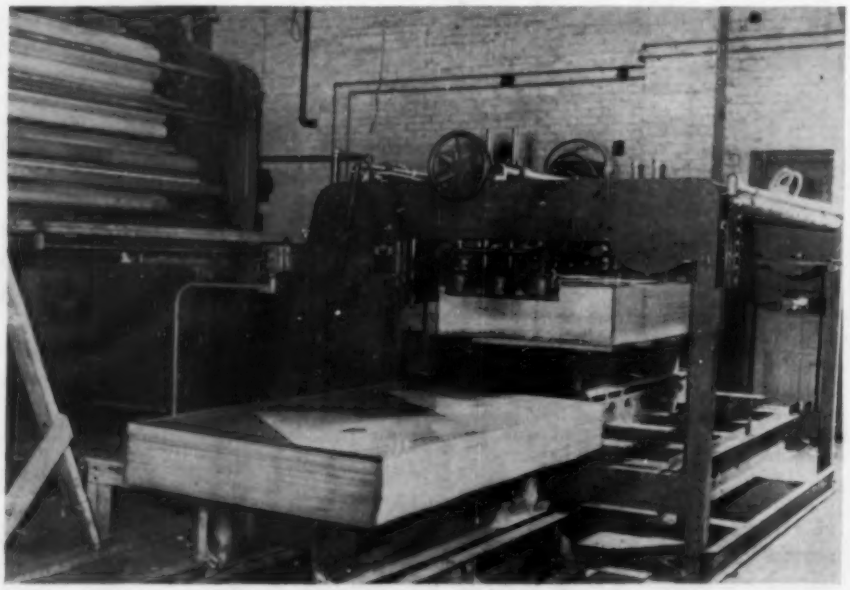

FIG. 1. FEEDING sheets into a lithograph press is a typical application requiring a high speed rugged mechanism.

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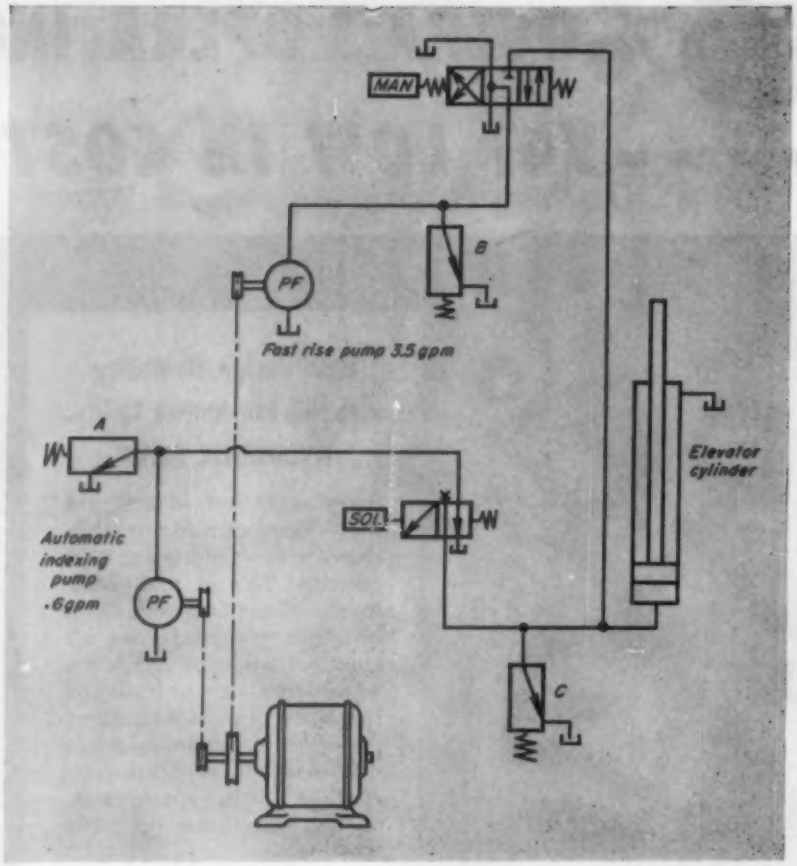

FIG. 2. POSITIONING the load of sheet metal is powered by this hydraulic circuit. Designed to handle a 7½ ton load, very little power is consumed by the small volume pumps. Unloading during idle periods is simply accomplished through the neutral porting of the control valves.

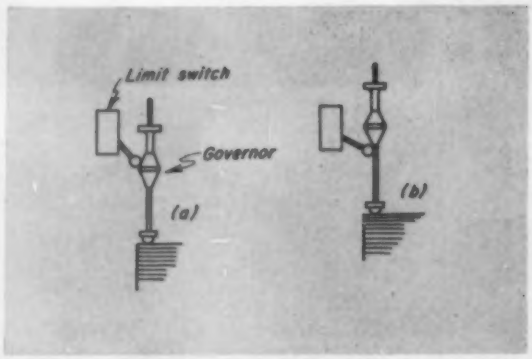

FIG. 3. AUTOMATIC INDEXING is signalled by this sensing device. When the load contacts the governor as in (a), the limit switch is closed to energize the solenoid valve causing the load to index upward to position (b). At this point the limit switch is opened to stop upward motion. As sheets are fed off the pile, the governor drops, to again initiate upward travel.

the automatic indexing pump takes over. A limit switch now operates the solenoid valve and allows oil from the "automatic indexing" pump to enter the cylinder. The load continues upward until it reaches the position indicated in Figure 3b, at which time it stops until the top few sheets are fed off, the flow of oil being momentarily stopped by closing off the solenoid operated valve by action of the governor operated limit switch. As sheets are fed off, the governor drops down (Figure 3a) and the solenoid operated valve again diverts oil to the cylinder, raising the load. This automatic indexing continues until the pile is depleted.

When the motor is operating but the load is not being moved (as in waiting while sheets are fed off, or installing a new load), oil is diverted from both pumps back to the tank through the neutral porting of the control valves. When the "fast rise" pump is supplying oil to the cylinder, oil from the "automatic indexing" pump circulates through the solenoid valve. When the "automatic indexing" pump is supplying oil to the cylinder, oil from the "fast rise" pump flows back to tank through the center position of the hand valve. It can be readily seen that the power demand is very small.

The elevator is lowered by gravity when the manual valve is positioned to permit oil flow from the blank end of the cylinder back to tank. The "fast rise" pump and the "automatic indexing" pump continue to circulate oil back to the tank.

Should the downward travel of the elevator be stopped suddenly, when the cylinder, port of the manually operated valve becomes abruptly blocked, relief valve "C" opens momentarily to relieve the shock-wave set up between the cylinder and both valves. ▼▼▼

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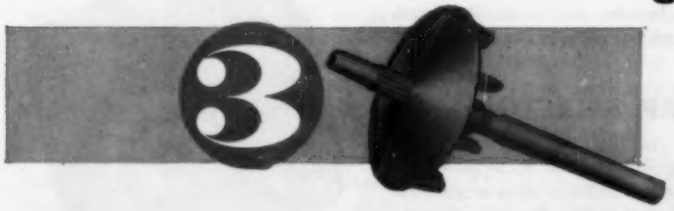

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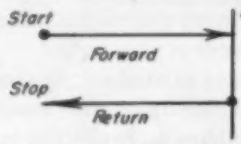
Problem Clinic

TIMER CIRCUIT

. . . for an 8 volt control valve

• By M. G. Saake

HOW many jobs do you have requiring forward motion—dwell—return? This pattern of operation—is very common and can be



readily accomplished with electrically controlled air or oil cylinders.

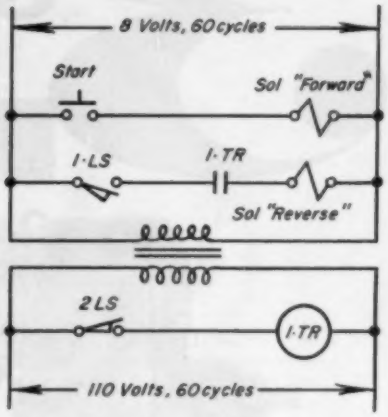
The electrical control circuit shown here is one of many ways available to the designer for obtaining this simple machine motion.

This circuit is used on an air operated packaging machine. The air cylinder has an integral directional control valve with 8 volt solenoids.

To obtain the necessary dwell, a motor timer is used. The timer coil requires 110v for operation. Because the solenoid valve does not have springs, a momentary electrical impulse is all that is needed to shift the valve.

Pressing the start button initiates forward travel by momentarily energizing the forward solenoid. As the air cylinder moves forward, a cam moves off 2LS which closes to energize the timer.

The air cylinder completes its forward travel, closes 1LS, and dwells in this position until the timer times out. When the timing interval is completed, contacts 1TR



close to energize the return solenoid. As soon as the cylinder moves back, 1LS opens to deenergize the reverse solenoid.

When cylinder reaches normal position, 2LS opens to reset the timer. The system is then ready for the next cycle to be initiated by pushing the start button. ▼▼▼

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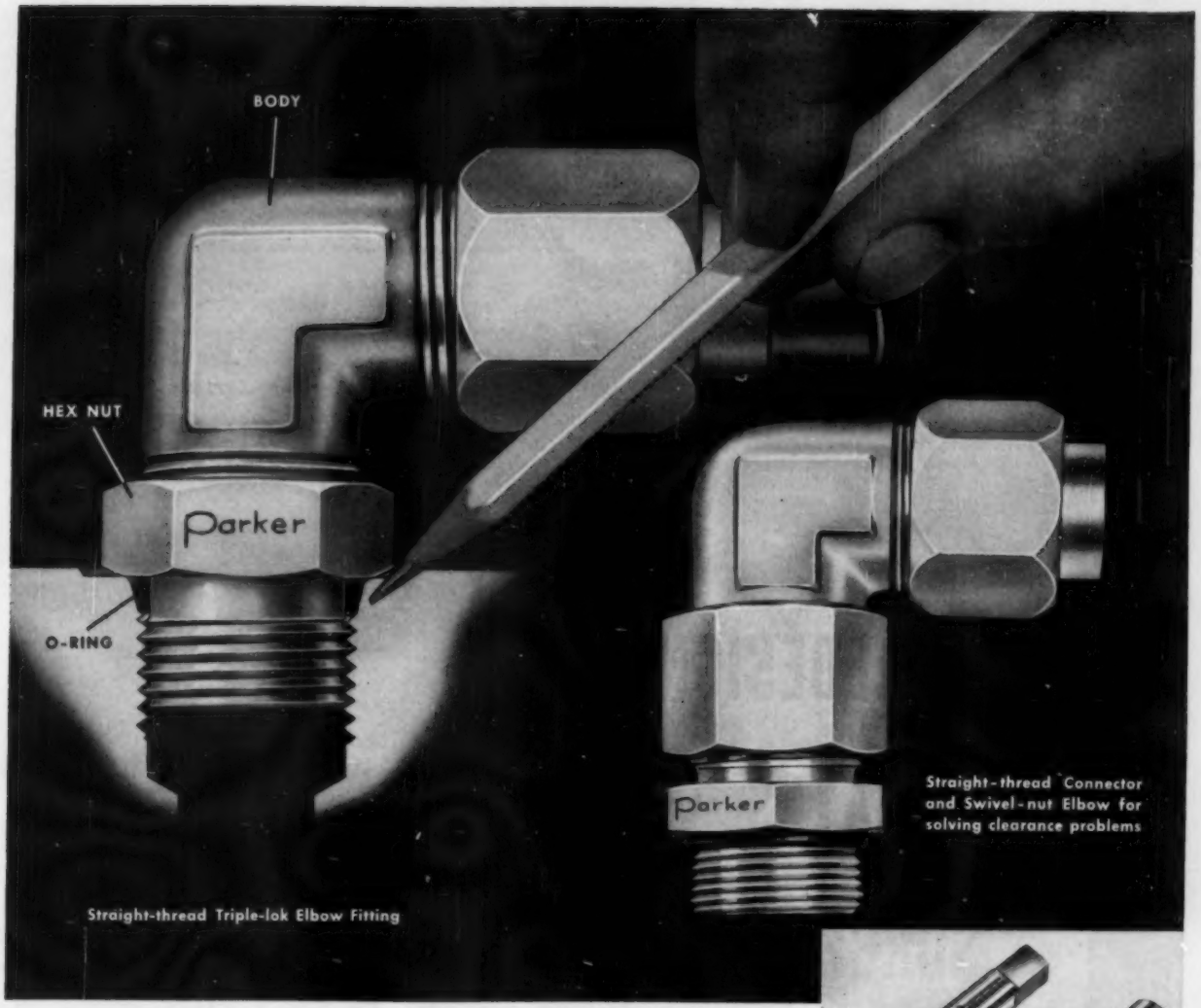

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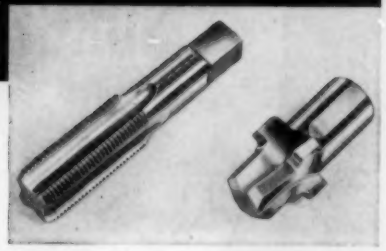

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CIRCUIT REDESIGN ELIMINATES SURGE

ON THE CONVAIR 340, a circuit redesign eliminated surges caused by high cycling of the unloading valve in the circuit which drives the fan for ground cooling of refrigeration unit.

• By D. M. Moore

USING an unloading valve in a circuit having a variable speed pump drive may result in an undesirable high rate of cycling of the valve. This causes surges and consequent fatiguing of the components and lines. When a hydraulically driven fan was added to the Convair 340 airplane for ground cooling of the refrigeration unit, fatigue problems resulted, with the unloading valve cycling at a rate of 120 times per minute. This problem was solved by replacing one of the two fixed displacement pumps with a variable displacement pump and making corresponding circuit changes.

ORIGINAL DESIGN

In the original circuit, two fixed-displacement pumps supplied fluid through check valves to the wing flaps, landing gear, entrance door, and windshield wiper; and through the bypass valve to the brake valves and accumulator. When the accumulator pressure reached 3000 to 3100 psi, the unloading valve dumped the pump flow to tank. The relief valve, set at 3250 psi, was for protection against excessive pressure in case the unloading valve stuck open. The bypass valve permitted depressurizing the system except for the line to the accumulator and brake valves. The solenoid-operated selector valve directed fluid through the priority valve which was set for a pressure of 2050 psi. A relief valve was installed in parallel with the fan motor and set at 2250 psi. The flow regulator was set at 4

D. M. MOORE, *Design Engineer, Consolidated Vultee Aircraft Corp., San Diego, Calif.*

Circle 145 →

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gpm. When the combined engine speeds totaled more than 1200 rpm, the pumps supplied more fluid than the fan consumed. This resulted in an operating cycle where the pressure increased, the unloading valve opened, the pressure decreased, and the unloading valve closed.

IMPROVED DESIGN

To correct this cycling condition, one of the positive displacement pumps was replaced by a variable displacement pump, and certain other circuit changes were made. The pressure is now nearly constant so that the flow regulator has been replaced by an orifice. The relief valve in parallel with the fan motor has been removed. The purpose of this relief valve was to quiet the fan. With the elimination of pressure oscillations by replacing for flow regulator by an orifice, the fan audible tone is stabilized and the relief valve is not required.

The orifice is set on the conservative side of 4 gpm. The pressure-compensated, variable delivery pump is set to deliver minimum output between 2950 and 3000 psi and the unloading valve is adjusted to open as near the 3100 psi side of the tolerance as is feasible to ensure no overlap when installed in the system.

SYSTEM OPERATION

To illustrate system operation, the following is a description of the sequence of events as the speed of both engines is gradually increased from 600 to 2000 rpm and then reduced to 600 rpm with the ground cooling fan operating.

At 600 rpm the capacity of both pumps is insufficient to bring the fan to a speed which will load the system to full pressure. Since the priority valve is designed to ensure pressure for braking, the pressure of the fluid to the fan motor will vary between the priority valve setting of 2050 psi and the pressure dictated by the air power being produced by the fan. As engine speed is increased, and fluid flow increases, the air flow load increases, and system pressure rises. At 2300 psi the priority valve is wide open, and at approximately 2650 psi the variable displacement pump begins to reduce output. As speed is increased further the pump produces minimum output, and the pressure which is produced entirely by the fixed displacement pump, rises until the unloading valve opens. The pressure in the fan line immediately drops and the variable displacement pump increases output sufficiently to maintain the load at a pressure of approximately 2700 psi. An unloading valve with a 2750 psi closing pressure is prevented from operating by the differential relief valve set at 200 psi. Further increase in engine speed results in a minor

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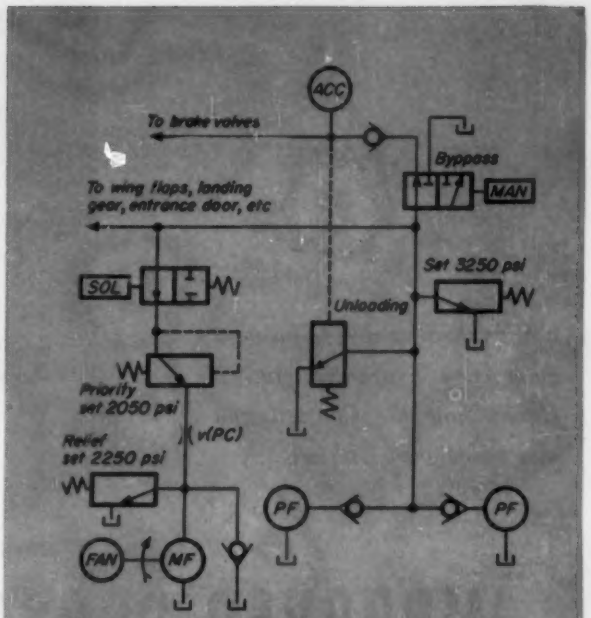
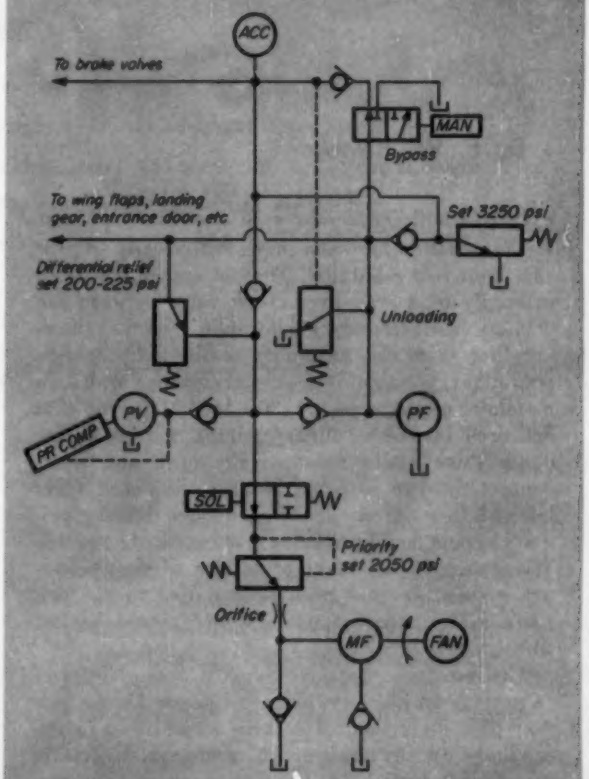


OLD SYSTEM had two positive displacement pumps driven by the engines. High cycling rate of unloading valve caused surges and fatiguing.



NEW SYSTEM replaces one positive displacement pump with a variable displacement pump. This, in addition to other circuit changes reduces unloading valve cycling by 99%.

What's the best way to provide emergency hydraulic power? Here's how the Constellation was redesigned with an . . .

CONSTELLATION hydraulic system has been modified to provide controlled cross-over between primary and secondary systems.

IMPROVED CROSS-OVER SYSTEM

• By E. W. Kesselman

THE hydraulic cross-over system on the Lockheed Constellation has been improved recently to provide increased reliability. The old system consisted primarily of a cross-over check valve between the primary and secondary hydraulic systems allowing flow from the secondary to the primary system. Thus whenever the primary pumps failed to maintain pressure within 300 to 400 psi of that delivered by the secondary pumps, the cross-over check valve would automatically open and interconnect the two systems. Because the check valve allowed flow in one direction only, a healthy primary system could not be used to supply the secondary system in the event of failure of the secondary system. In case of a broken line in the primary system, the secondary system could be lost through this break.

The previous cross-over system was developed to provide an alternate source of power for the primary, or flight control system, in addition to the auxiliary booster system. An emergency hydraulic system was available to provide an alternate source of power to extend the gear and provide adequate brakes. A removable hand crank was installed to operate an emergency drive unit for operation of the wing flaps. Thus each normal system was backed by an emergency source of power. Protection was provided against everything but multiple failures, such as failures of two hydraulic pumps on one system and the emergency system at the same time. However several incidents had proved that multiple failures were possible.

E. W. KESSELMAN, *Assistant Project Engineer, Lockheed Aircraft Corp., Burbank, Calif.*

MODIFIED SYSTEM

As a result of these incidents, a different approach to the cross-over was made. If the primary system is healthy, why not borrow it for a short time and extend the landing gear and flaps? If only the secondary pumps are inoperative, there is no problem. However if there is a break in the secondary pressure lines, the primary system can not supply it.

Instead of the former cross-over check valve, a motor-actuated cross-over valve has been installed and is closed in normal operation. The primary and secondary system pressure is supplied to the equipment in their respective systems. The return fluid from each system is directed through a filter and return bypass valve to a separate side of the main reservoir. The return bypass valves are of a spring-return, pilot-operated type. If the pilot pressure at the bypass valve is lost, the spring positions the valve so that the return fluid through the valve

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2½"	32.36	34.12	34.68	35.24	36.36	37.48	38.60	39.72	41.40
3"	35.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	48.96	51.92	52.88	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
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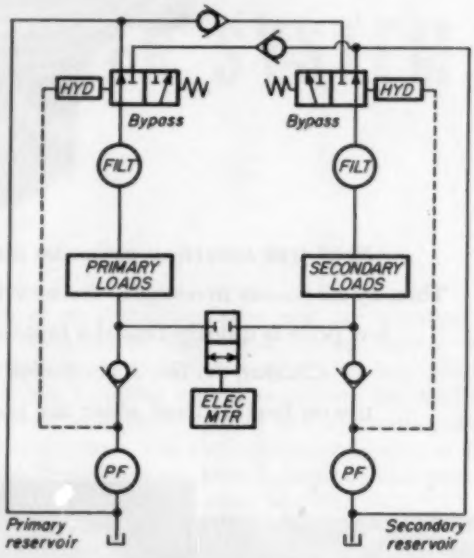
IMPROVED CROSS-OVER SYSTEM

is directed to the side of the reservoir corresponding to the operating system. Two check valves are connected with the bypass valves in the return lines to the main reservoir. These prevent reversal of fluid flow through the bypass valves and loss of fluid through broken lines or faulty equipment.

With the secondary system inoperative, the cross-over valve may be opened by the flight crew to permit primary fluid to operate the secondary system units. A check valve is installed with the secondary system pump to prevent the loss of fluid from ruptured lines or faulty secondary pumps. The return oil is ported back through the return bypass valves into the primary side of the main reservoir, since the loss of secondary pressure shuts off the flow to the secondary side of the reservoir.



CROSS OVER VALVE is now motor actuated and controlled by flight crew. Bypass valves route drain fluid to proper reservoir when either or both systems are in operation.

CREW RESPONSIBILITY

The new cross-over system is very simple, but it must be used with some discretion. The system is not automatic and the flight crew must decide whether or not to utilize hydraulic pressure of the good system to actuate components of the faulty system. They must consider that the oil being transferred may also be lost if the fault is the result of a broken line. If the crew is in doubt whether to open the cross-over valve, they should first use the appropriate standby systems. For example, the auxiliary booster should be turned on for the control boost system, and the emergency extension actuated for gear extension and brakes. Should these standby systems by ineffective, the cross-over valve should be opened to see if it will do the job. ▼▼▼

REDESIGN ELIMINATES SURGE

Concluded from page 99

increase in pressure which decreases pump displacement sufficiently to hold the flow nearly constant.

As the engine speed is decreased, the pressure in the fan line decreases. The variable delivery pump yields full delivery at 2650 psi and the unloading valve senses 2850 psi because of the differential relief valve. Further decrease in engine speed drops the pressure until the unloading valve closes and forces the variable pump into near minimum output with a small increase in line pressure. As the engine speed continues to decrease, the variable displacement pump output increases and finally the priority valve throttles the fan supply when the total pump delivery can not maintain the fan airload.

ADDITIONAL MODIFICATIONS

To eliminate noise when operating with the bypass valve open to tank, the variable displacement pump line is now connected to the accumulator side of the bypass valve. With the connection to the relief valve and the arrangement of check valves, the relief valve serves both pumps. This circuit allows the variable delivery pump to remain in minimum output position when the bypass valve is open to drain, instead of pumping with maximum output to drain.

The return line from the fan motor formerly connected into a manifold with drain lines from the unloading valve, relief valve, and bypass valve. A separate return line for the fan motor has been installed to isolate the fan motor drive shaft seals from shock waves generated by operation of the unloading valve or bypass valve. Prior to this modification, peak pressures of 500 psi and 30 millisecond duration were recorded at the fan motor discharge port, and peak pressures of 700 psi, 30 millisecond duration were recorded in the return manifold. No seal failures have been reported on modified systems. Connections to the fan motor are flexible hose to damp pulsations from the fan motor and prevent transmitting these pulses through the case drain line to the shaft seal. The inlet hose connection isolates the fan motor from metallic tubing minimizing noise transmission into the structure.

System tests indicate that cycling of the unloading valve has been reduced more than 99% resulting in less fatigue on hoses and tubes in the pressure lines, in the bypass valve case, and in the return lines. Because the unloading valve handles only half the previous flow, pressure peaks in the return system are reduced. ▼▼▼

Next Month: Reports on the SAE Aircraft Equipment Committees (A-3, A-6C, and A-6). A number of important items: new specifications for high pressure hose; high temperature, high pressure pumps and motors; high temperature packings for pneumatic and hydraulic systems; 2-5 micron filters and hydraulic nomenclature, will be discussed.

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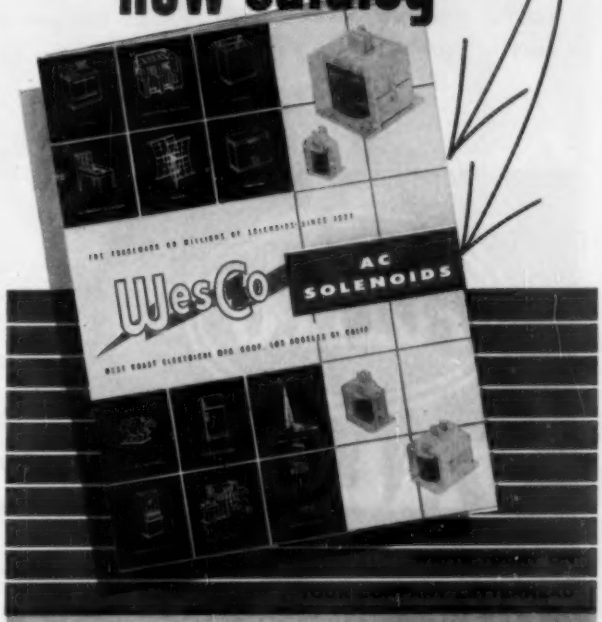

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An AH Report . . .

New British Aircraft Components

In September, John Lankester, APPLIED HYDRAULICS, *European editor, covered the 1955 Flying Display and Exhibition at Farnborough, England. This annual exhibit is sponsored by the Society of British Aircraft Constructors. The latest in aircraft designs—which can be made public—are shown on the ground and in the air. The display includes accessory products. Many of these are fluid powered units. Mr. Lankester brings us up-to-date.*

New aircraft brake—Stopping large, modern aircraft having an 8 wheel bogie requires a new approach. Dowty Equipment Ltd, showed a novel runway brake actuated by hydraulics. Surprising as it may seem, this design can be traced back to a boy's soapbox racer where the boy pushes a board on the ground (and sometimes his shoes) to bring his racer to a stop.

The Dowty design is aimed toward increasing brake efficiency on modern planes and, at the same time, cutting down on the weight and complexity. This runway brake can replace present wheel brakes and greatly simplify the hydraulic or pneumatic design.

Figure 1 shows the new brake assembly. A pad of synthetic rubber bonded to a metal detachable shoe, is located between the wheels of the bogie type landing gear. The shoe is lowered by a hydraulic cylinder onto the runway to provide the stopping friction. By transferring the friction from the tires to the easily replaced rubber pads, the tires are protected from the wear and distortion caused by heavy braking loads, and the heat generated is dissipated on the runway. The reduced weight and tire wear, together with improved friction in wet conditions are claimed to be important advantages. Also this oil powered pad can be used to raise the aircraft off the ground for wheel changes. By providing this built-in jacking, the ground equipment necessary for servicing is reduced.

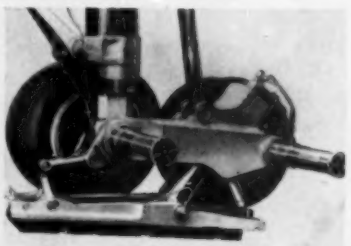

FIG. 1. HYDRAULICALLY powered brake reduces tire wear on large modern planes.

Fluid motor with a brake—Another entirely new component shown by Dowty is their hydraulic motor, Figure 2 which has a built-in brake. The brake is applied by springs and released by the oper-

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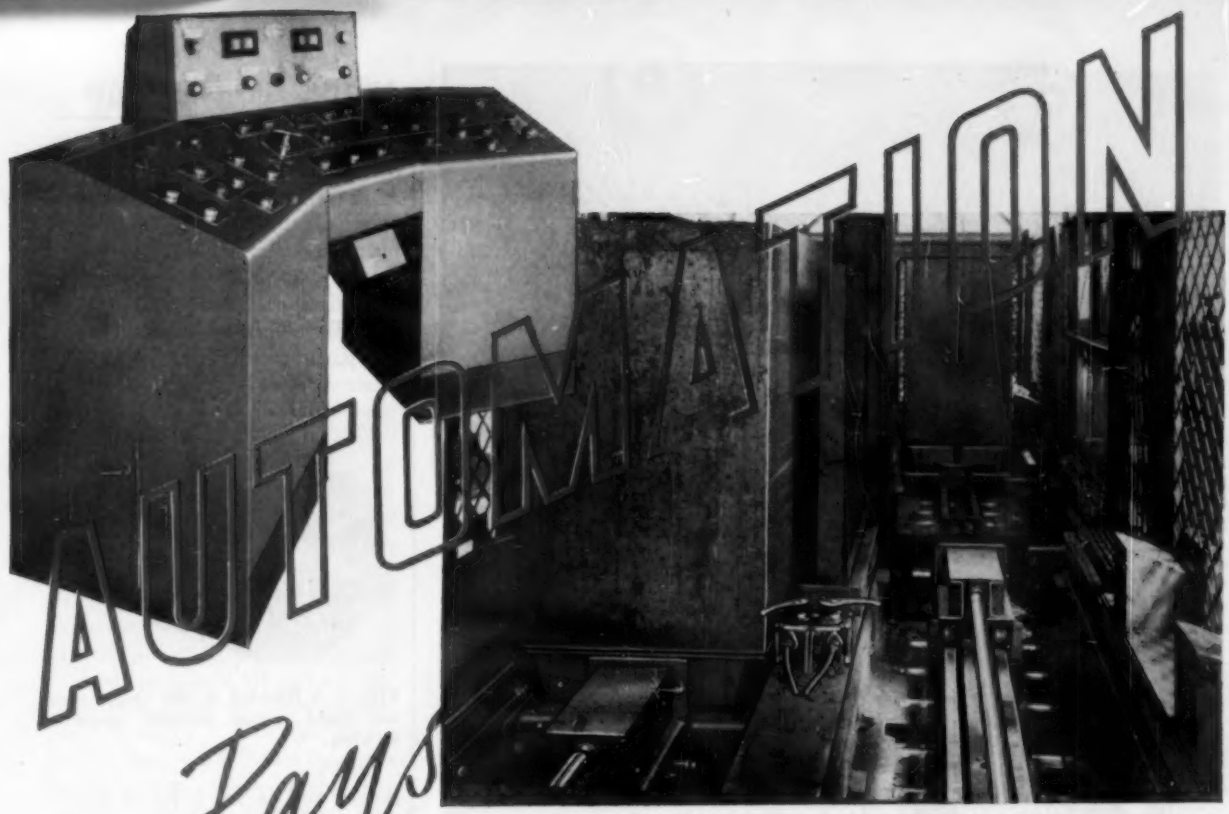

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NUMBER OF TUBS/CONTAINERS	650	6	INCREASED SAFETY WITH LESS MOVING MACHINERY
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THESE OUTSTANDING FIGURES—*reproduced by permission of the National Coal Board — illustrate the economy and efficiency of the Torley Container Automation powered and controlled by Keelavite Hydraulics at Rawdon Colliery in Leicestershire.*

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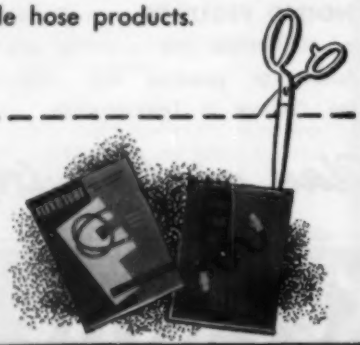

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ating pressure. This enables any component, such as a screw-jack operated wing flap, to be locked securely in any desired position regardless of the hydraulic pressure. Developed from the Vardel* pump, the motor has 7 radial cyl-

FIG. 2. A BRAKE in this radial piston fluid motor permits positive locking.

inders and is rated for a maximum pressure of 4,400 psi and speeds up to 5000 rpm. The oil input is 2.7 gpm per 1000 rpm. The hp curves show an output of over 10 hp using 2000 psi pressure and 4000 rpm. At 3500 psi the motor develops over 20 hp when turning at 4000 rpm.

Aircraft pumps—The range of Dowty pumps has been augmented by a new version of the Vardel variable delivery 4000 psi pump. This new model gives increased delivery by the use of 14 pistons.

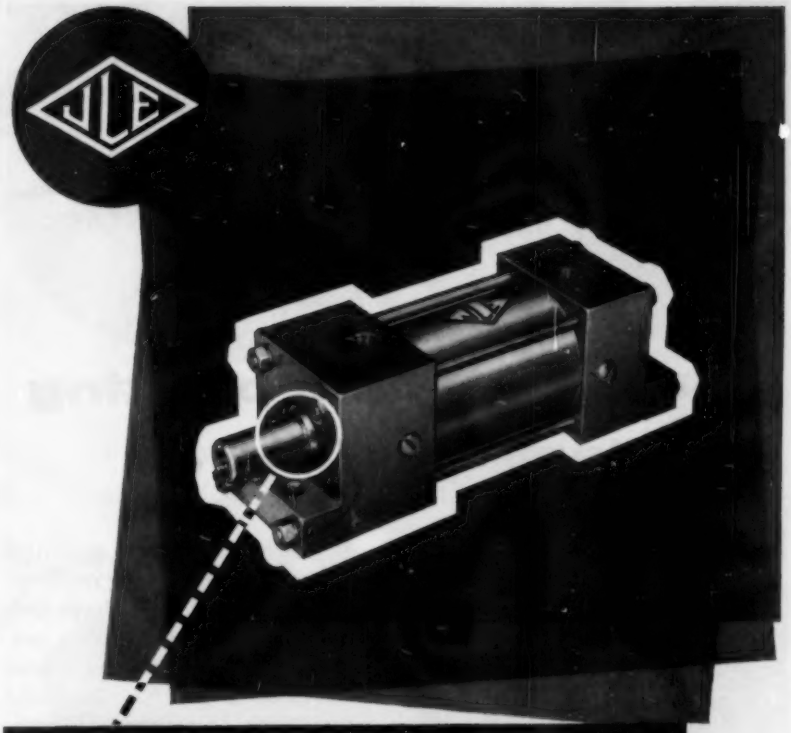
Sperry Gyroscope Ltd. is manufacturing, under license in the U. K., Vickers (Detroit) pumps and motors. The smallest of this range is a swash plate unit which, used as a pump, delivers 2 gpm at 6,000 rpm against a pressure of 3,000 psi. By transposing inlet and outlet ports this can be converted into an hydraulic motor developing 4.4 hp at 6,000 rpm on constant operation and this power can be increased to 9 hp at 12,000 rpm for intermittent operation. A larger model gives, as a pump, 5.5. gpm at 3,000 rpm against pressures of 3,000 to 4,000 psi and when transformed into a motor the horsepower is rated at 3 at 3,000 rpm using 4 gpm at 1,000

*See "*Trends in British Aircraft Pumps*" by John Lankester,* APPLIED HYDRAULICS, *August,* 1954.

psi. These units are compact and light and the range will be extended up to units of 20 gpm weighing only 20 lb. Pump and motor can be used together to give infinitely variable and reversible power transmission.

Air turbine driven pumps—Several instances can be seen of the increasing use of air turbines for the driving of accessories such as emergency hydraulic pumps, electric alternators and fuel booster pumps. Sir George Godfrey & Partners Ltd., exhibited a 15 kva alternator powered by a turbine driven by air bled from the main jet engine compressor. The Self-Priming Pump and Engineering Company employ an air turbine to provide power for their 3,500 gph fuel pump. A ram air turbine has been designed by the Plessey Company to drive a hydraulic pump for emergency use should the main engine driven pumps fail for any reason. This unit is lowered into the air stream and, at a speed of 150 knots, generates 2 hydraulic horsepower for operation of the powered flying controls in emergency. As the air speed increases the hp available increases up to a speed of 320 knots when it is possible to derive 4 gpm at 3,000 psi from this method of pump drive. Above this speed a built-in governor limits the pump delivery. The unit automatically swings out into the airstream in the event of failure of the normal hydraulic supply. Another instance of the use of air bled from the compressor of the jet engine is for the pressurization of the anti-G suit. By means of a precision pressure reducing valve a direct tapping from the turbine compressor is reduced from 150-300 psi maximum to the pressure necessary to compensate for 8 G. The temperature range that can be handled by this reducing valve developed by the Hymatic Engineering Company is from −30° up to 100° C. A relief valve is incorporated to limit the pressure to 10 psi.

Servo control systems—Several types of hydraulic power-operated flying control systems, ranging from the linear piston/cylinder pattern for power asistance, to the more advanced fully power actuated controls for large aircraft,



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For applications requiring a cylinder of exceptionally rugged construction in locations where complete accessibility is difficult. Field use over the past three years has proven these cylinders to be practically maintenance free.

Designed for low and medium pressure air and oil service up to 250 psi pneumatic and 500 psi hydraulic pressures. A full line of bore sizes from 1½ to 14 inches is available. Supplied in any one of a choice of 10 interchangeable stock mounting types, automatic cushioning available on all standard models or adjustable valve cushioning on special models.

- ✓ Blanchard ground, solid steel heads.
- ✓ Pre-stressed, high tensil tie rods.
- ✓ "V" packings, self adjustable to differences in pressures, maintain a low coefficient of friction.
- ✓ Stainless steel rod is standard equipment on all JLE square cylinders.
- ✓ Meets J. I. C. Standards.
- ✓ Extra long bearing provided for strokes over 84 inches.
- ✓ Leather packings, with special impregnation made to JLE specification, provided for hydraulic use.
- ✓ High quality, self-locking nuts used throughout.
- ✓ 3 rod end types available at no extra cost.

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The JLE "Work-horse" Cylinder is for applications requiring a less expensive, pneumatic cylinder for pressures up to 250 psi. It is available in bore sizes from 1½ to 10 inches in either cushioned or non-cushioned models.

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- ✓ Cylinder walls of heavy brass tubing. Can be "water fitted".

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were shown. There are many different methods employed to enable hydraulic pressure to be directed to power the movement of aircraft control surfaces: The simplest of these uses a selector valve to divert the pressure oil to either side of a ram which actuates the surface and includes follow-up linkage to neutralize the selector when the desired setting has been achieved. One type uses a reversible, variable delivery hydraulic pump and by servo assisted movement of the controlling mechanism the flow is directed at the desired rate to either side of the actuating piston until the requisite movement of the control surface has been achieved whereupon the output of the hydraulic pump falls to zero and further movement of the surface ceases until a fresh signal is fed into the pump from the pilot's column. Where hydraulic power is used to operate the flying control surfaces the input loads are very light and developments have been made and are in progress whereby the automatic pilot and autostabiliser linked to the power operated control mechanism. By careful matching of the automatic pilot and power control systems it is possible to dispense with most of the amplifiers and servos in the auto-pilot.

New licensing arrangements—A link-up between the British Oxygen Company and the Aro Equipment Corporation of America permits the former to manufacture and sell the apparatus connected with the supply storing and dispensing of liquid oxygen and liquid nitrogen for use in aircraft. The new company is known as the British Oxygen Aro Equipment Company, Ltd.

An agreement has also been concluded between D. Napier & Sons Ltd., of London, famous for many years as aero engine manufacturers, and Power Generators Incorporated of Trenton, New Jersey. This arrangement permits Power Generators Inc. to manufacture and market the Napier "Spraymat" electrical de-icing system in the Eastern States of the U.S.A. Aeroquip flexible hose line with detachable, re-usable fit-

tings, as was announced some time ago, is now being manufactured and sold in the U.K. by the British licencees, Super Oil Seals and Gaskets, who also exhibited their wide range of hydraulic packings.

New Plumbing—For installations where flexible hose is necessary but where high temperatures make the use of rubber impracticable, the Avica Equipment company have developed convuluted stainless steel hose. There are however instances where neither rubber nor metallic flexible pipes can be used but where movement of the component necessitates move-

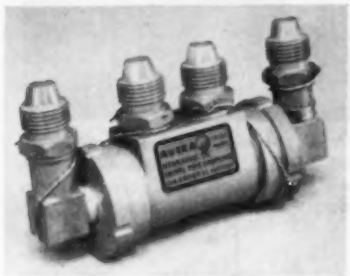

FIG. 3. HIGH PRESSURE, 4000 psi, swivel coupling requires a maximum torque of 8 lb-in for rotation.

ment of its supply pipes. For such cases Avica produce a high pressure swivel coupling, Figure 3, incorporating ball bearings to minimize turning friction, and microfinished parts for good sealing and reduced gland friction. Capable of handling pressures of 4,000 psi these swivel joints permit rotation with a maximum torque of only 8 lb-in. The lowest torque achieved in production is 2½ lb-in. and the normal figure varies between these two figures. These torques vary with the size, pressure and temperature of the fluid.

Industry growth—The importance of the British aircraft industry can be gauged from the value of its export business which during 1954 amounted to £56.3 million: For the first six months of 1955 the value of exports reached £30.5 million. Apart from the importance of the aircraft industry to national security, its contribution to the economic stability of the U.K. is growing. To judge by the export orders announced at Farnborough this year, is likely in 1955 to break all previous records. ▼▼▼

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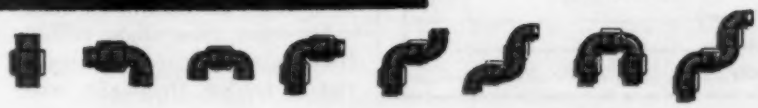

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CYLINDERS
(air and hydraulic)

. . . an important part of the automation picture at

MICHIGAN TOOL COMPANY

O-M cylinders (shown here installed on an automated speeder) are an integral part of "Gear-O-Mation" at Michigan Tool Company. In their automatic gear production line, O-M cylinders provide the muscle in the movement or holding of parts.

Important factors in Michigan Tool's choice of O-M cylinders for these machines were: *COMPACTNESS OF DESIGN* — their cleaner, more streamlined construction that allows installation in less space; *LESS MAINTENANCE* — easier to clean, inspect, remove, disassemble and service, if necessary, with no special equipment or skills needed. Knocks out downtime, keeps loading equipment in continuous operation.

O-M air and hydraulic cylinders are available in complete range of sizes (1½ to 8" bores), with standard, 2 to 1 or oversize rods. All steel construction with bearing bronze. Completely interchangeable parts. Immediate delivery on many sizes.

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STRIKING CONTRAST between new, compact two-fluid manometer and 10-foot water manometer, formerly used, is shown here by Win Alderson, Ryan instrument lab chief.

Unique Floating Fluid Manometer

A UNIQUE, new pressure gauge blends sensitivity with compactness. It is so sensitive that it will indicate pressure changes of only 1/500th of a pound per square inch. It is simple and fool-proof to use and only 18 inches tall.

Conceived by Win Alderson, of Ryan Aeronautical Company's instrument laboratory, the new instrument is a two-fluid manometer, tailored for pressure-testing the huge external fuel tanks built for Boeing KC-97 Stratofreighters. Its basic design could be used for a variety of other pressure measuring tasks.

To insure fuel tightness, the large aluminum fuel tanks are pressure-tested by subjecting them to a pressure of 3.5 psi for 45 minutes. During this extended interval, even slight leaks will be evidenced as a drop in pressure in the compressed air held in the tanks.

To detect these slight pressure changes, a sensitive type manometer is needed. Originally, water manometers were built and used. Water possesses the correct specific gravity for indicating slight pressure changes with good visibility in a manometer tube. One pound per square inch of pressure will support a column of water about 27 inches high and this length of column can be calibrated into a sensitive barometric gauge.

But, to get pressure readings which range between three and four psi, the water column had to be ten feet tall and this was an extremely unwieldy instrument.

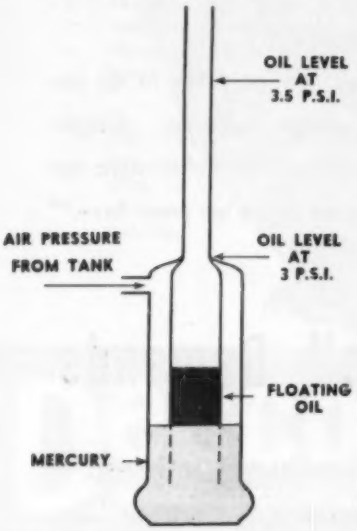
On the other hand, a mercury manometer would not show the very small pressure changes which might occur. Weighing 14 times as much as water, a column of mercury of less than two inches is supported by a pressure of one pound per square inch.

Production necessity is often the mother of laboratory invention. This was no exception. Win Alderson, and other technicians, solved the problem by using both mercury

and a light oil in an ingenious combination.

The sensitive manometer consists of a glass capillary tube blown with a larger diameter open reservoir at one end. This reservoir is inverted and placed within a closed glass container, which is attached to the pressurized tanks by a rubber tube.

Two liquids are poured into the glass container: mercury and manometer oil, which is dyed red for better visibility. The oil has the same specific gravity as water and has practically zero coeffcient of evaporation. The oil floats on top of the mercury, which is 14 times heavier.



MANOMETER OIL, within inner tube, floats on mercury at bottom. At 3 psi oil enters indicator tube.

The amount of mercury used is carefully measured so that when a pressure of three psi is impressed on the system, the oil, floating on top, will be raised to the opening of the small capillary tube. As the pressure rises above three psi, the red oil shoots up the tube at an accelerated rate of 27 inches per psi. This presents the viewer with a readily observed indication, even for pressure changes of as little as 1/500th of a pound per square inch.

Another advantage of the manometer oil is its sharply defined meniscus which is much easier to read than the wider formation at the top of a water column.

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"After the machine was built there wasn't enough force to do the job. We may have 'goofed' a bit on the design; however, changes in the work knocked out whatever factor of safety we thought we had. Aside from looking for a new job, where do we go from here?" Here's a good answer.

INTENSIFIER Meets "Beefed-up" Demands

● By J. R. Fawcett

WE designed the intensifier shown in Figure 1 to overcome a very awkward situation which arose when it was discovered that the calculated force available from the installed cylinder was considerably short of that actually required. To fit a higher pressure pump or a larger cylinder was impractical as neither could be accommodated. The expense of making any major alterations of this nature would also have been formidable.

The intensifier operates automatically and is designed to give a 2:1 pressure ratio. It is designed to mount in the cylinder line with its axis vertical. Vertical mounting makes it unnecessary to spring load the built-in check valve.

For the approach stroke of the cylinder shown in Figure 2, oil from the 4-way valve enters the intensifier at the bottom and passes through the ball check valve and hollow plunger directly to the blank end of the cylinder. While the piston is advancing, there is little back pressure and the full pump output passes through the intensifier. When the piston meets a resistance and the pressure builds up, oil leaks through the taper valve to the underside of the plunger head. The rate of leakage is adjustable but in any case is negligible until the pressure builds up to the pump relief valve setting. The intensifier plunger moves forward slowly until the pilot on the cap clears the hole in the plunger. Now the full

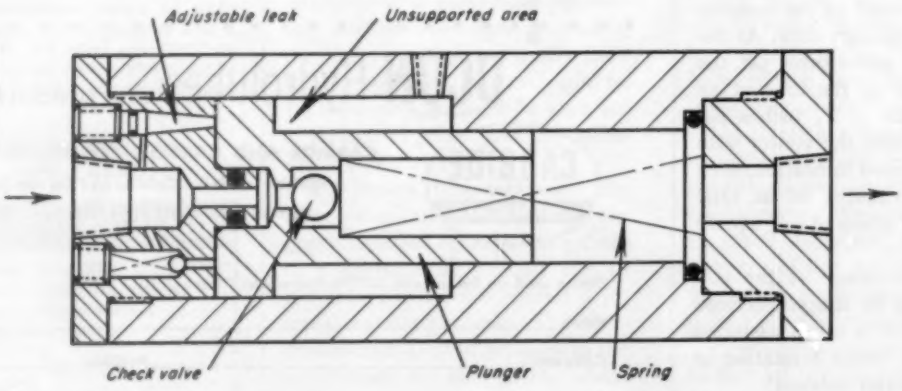

FIG. 1. Cross-section of intensifier. It is designed to mount vertically.

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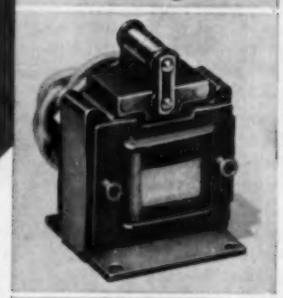
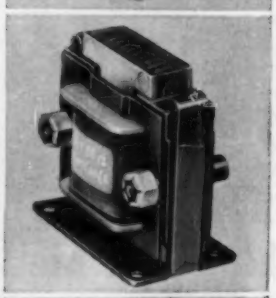


VERTICAL PULL TYPE—SHOCK-MOUNTED

VERTICAL PUSH TYPE—WELDED BASE



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TWO HORSEPOWER

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PROBLEM CLINIC

Continued

pump delivery acts on the plunger head. At the first movement of the plunger, the ball check valve shuts and remains shut because of the pressure increase on the cylinder side of the intensifier.On the return stroke, the operation of the 4-way valve relieves the pressure on the underside of the plunger which is returned by the spring. The oil trapped below the plunger is diverted through the small ball check valve. Because the intensifier will not allow return flow, a sequence valve is used to by-pass oil to tank on the return stroke as soon as the pressure builds up in the rod end of the cylinder.

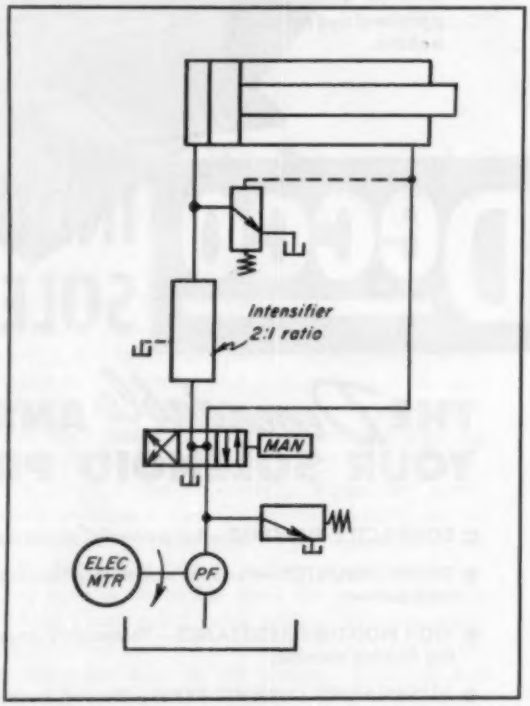

FIG. 2. Machine circuit using in-line intensifier to step up pressure on the cylinder.

The unusual feature of this intensifier is the method of delaying the admittance of pressure to the plunger head until as much work as possible has been done at low pressure. As soon as the pump pressure reaches the head, the plunger must move because of the unsupported area. The ideal condition is for flow through the intensifier at the pump pressure to stop because of piston resistance, slightly before the pilot comes free. The intensifier takes over immediately.

Although it was finally decided to use the adjustable leak shown, consideration was also given to the alternative of a spring-loaded ball valve for admitting oil to the plunger head. This would have been set to about one half the pump relief valve pressure. It would be a convenient alternative if a non-adjustable method were preferred. ▼▼▼

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VERY LITTLE FORCE from the helmsman is needed because the steering mechanism has been modified to include a . . .

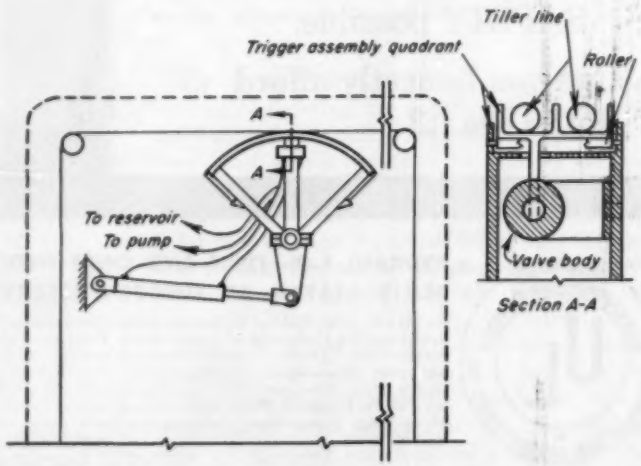
Low Cost Hydraulic Booster Circuit

• By W. E. Glissmann

DO you have a work boat with a tiller line and quadrant steering system? Would you like to install a simple, economical hydraulic booster steering system without disrupting your mechanical system? The diagram shows a scheme which has worked satisfactorily and which is made up of readily available hydraulic components. The valve is a 4-way, three position, manually controlled spring centering valve with cylinder ports blocked in center position.

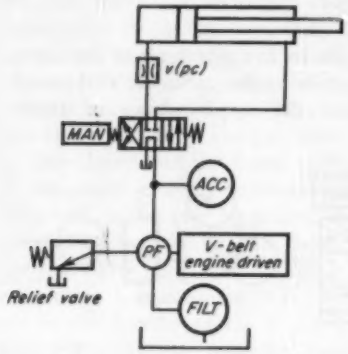
Movement of the pilot house steering wheel moves the trigger assembly, which in turn, moves the valve spool to allow oil to flow to the cylinder. As the cylinder moves the rudder and quadrant, it moves the attached valve body, tending to center the spool to the cylinder ports blocked position. Centering of the spool is accomplished and rudder movement stops when movement of the steering wheel stops.

This action takes place very rapidly. So rapidly, in fact, that during movement of the rudder from left to right, the action is a series of starts and stops giving a



ORIGINAL MECHANICAL steering system remains intact. A valve and cylinder are added.

chattering effect. This is eliminated by installing a metering valve which is adjusted to give the speed of cylinder action desired. The hydropneumatic accumulator will minimize shock on the lines caused by abrupt action of the 4-way valve.



STANDARD, readily available hydraulic components are used in the steering booster circuit.

With this booster system, the rudder locks in any position that it is stopped. This allows the operator to let go of the wheel and attend to other duties without the wheel spinning hard over and off course. ▼▼▼

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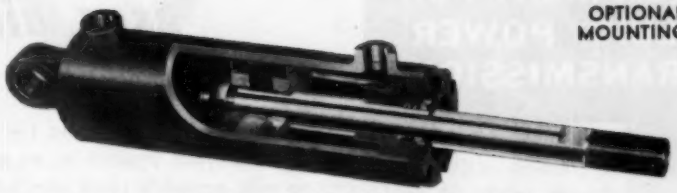
Piston Style, Double Acting
BHEW Hydraulic Cylinder

OPTIONAL MOUNTINGS



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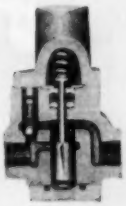

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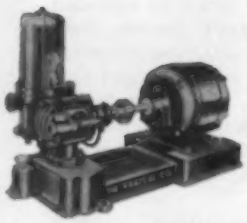

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Our exclusive Class 26 design air filter can be furnished as an integral part of each pump, up to 10 cfm—to produce oil-free discharge air and also conserve the lubricating oil.

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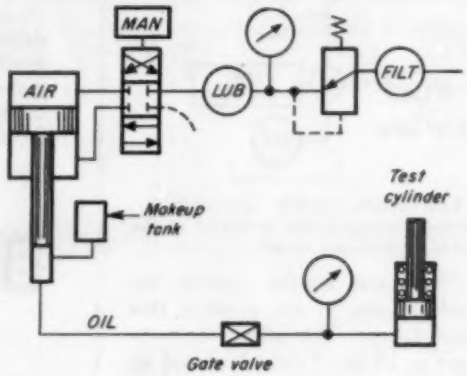
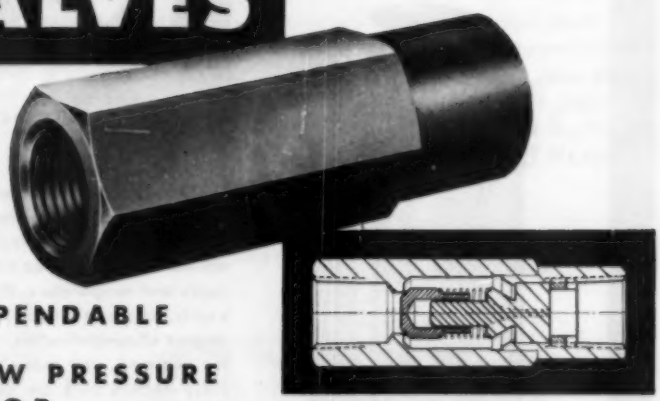
A SIMPLE arrangement for testing brake systems in an automobile assembly plant uses an oil cylinder to apply force to the automobile master cylinder. This simulates the application of force



SPRING - LOADED OIL CYLINDER actuates master cylinder simulating brake pedal force.

CHECK VALVES



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through the brake pedal when the car is being driven. A pressure of 1800 psi is created in the lines and cylinders of the brake system. A drop in this pressure indicates a leak in the system.

Shop air is supplied to the 4-way valve through a filter, regulator, and lubricator. With the gate valve open, the 4-way valve is first positioned to admit air to the top of the booster. The test cylinder extends and actuates the automobile master cylinder. The gate valve is then closed and the 4-way valve is positioned to neutral. Leaks are indicated on the gage by a drop in pressure. After checking for leaks, the gate valve is opened and the 4-way valve is positioned to admit air to the bottom of the booster, allowing the spring-loaded test cylinder to retract. A make-up oil reservoir connected to the booster adds oil lost by leakage.

The oil gage, gate valve, cylinder, and 4-way valve are mounted on a fixture which is clamped on the automobile chassis. The equipment is mounted over the automobile assembly line and is suspended from a pulley. ▼▼▼

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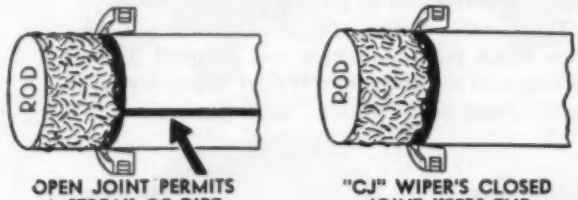

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For those dry operations requiring absolute freedom from dust or dirt passing through joint of ring to bearings or packings, we have especially designed—the

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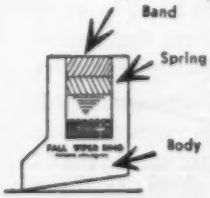
Spec. Mil-S-5049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 13", diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 2 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) an endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.



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Continued from page 70

The third important sealing surface pair is the step surfaces in the step seal joint. The ability of the ring joint to produce an effective seal depends on dimensional control much the same as described for the other two surface pairs, except that these are controlled by the ring manufacturer rather than the cylinder or piston manufacturer.

Sealing ring side clearance in the ring groove is also an important dimension. Primarily, side clearance is required to allow for dimensional tolerances in the groove width and ring width, however, in high temperature applications, additional allowance must be made to compensate for differential expansion. Generally speaking, it is desirable to minimize the amount of side clearance and allow only the amount needed to prevent the ring from wedging in the groove; this is especially true in multi-piece ring applications. If a spring is used to obtain the initial contact between the ring side and ring groove, side clearance may be considerably larger.

As pointed out earlier, the sealing ring joint provides a seal at the ring ends and permits relative motion between the joint surfaces. With a ring joint meeting the dimensional conditions already described, it is apparent that end clearance is not a critical factor in the sealing ability of a ring. Data from tests bear out this conclusion in Figure 9. This data also shows the extreme difference in leakage obtained using a step seal joint with wide end clearance compared to that obtained with a very small end clearance in a straight cut ring.

To evaluate the importance of sealing surface

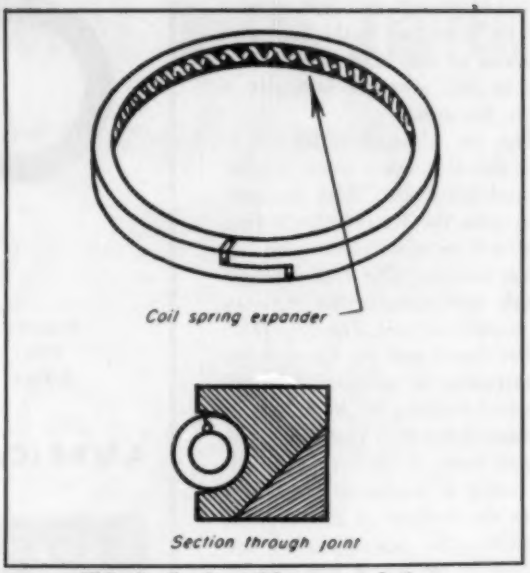


FIG. 8. Conformable step seal ring

contact, a study was made of oil flow through a step seal joint. Figure 10 shows the leakage rates for several pressures and step clearances. The larger clearances are typical of those used a few years ago in low pressure applications operating with very viscous hydraulic fluids. To operate the present high temperature, high pressure, low viscosity hydraulic systems efficiently, the sealing ring joint clearances have been reduced to provide the effective seal required in these applications.

The metallic sealing ring development program from which this information was gathered is continuing with the purpose of further improving sealing efficiency of piston ring type seals. ▼▼▼

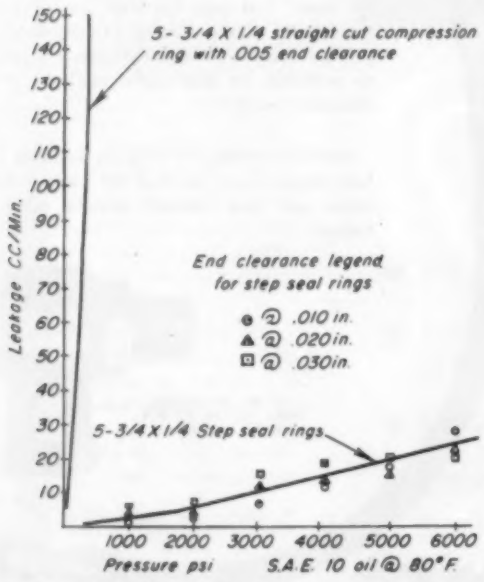


FIG. 9. Effects of end clearance on leakage of straight cut and step sealing rings

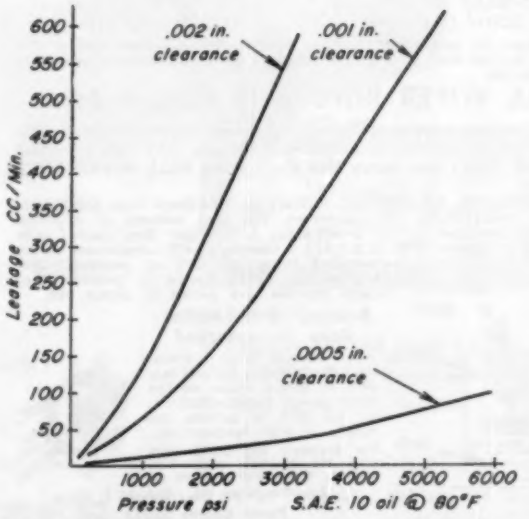
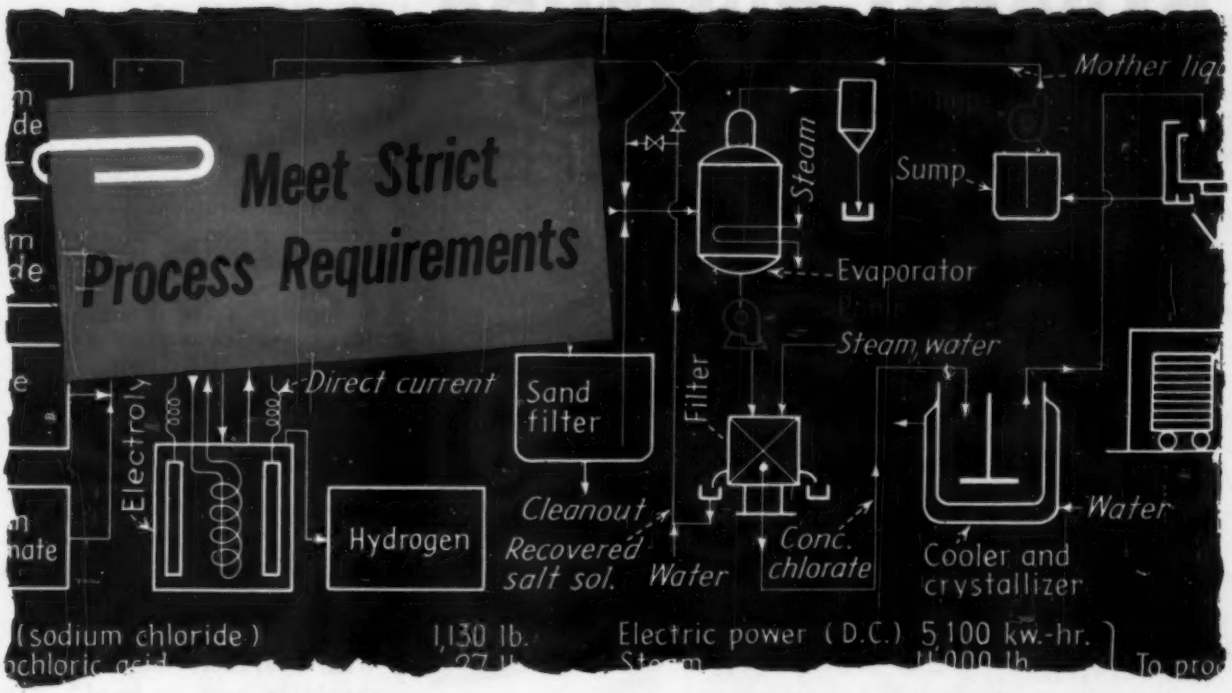


FIG. 10. Effects of step clearance on leakage for 5¾ x ¼ step seal rings



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Models 2F and 2J
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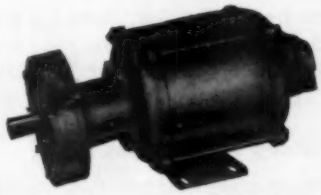

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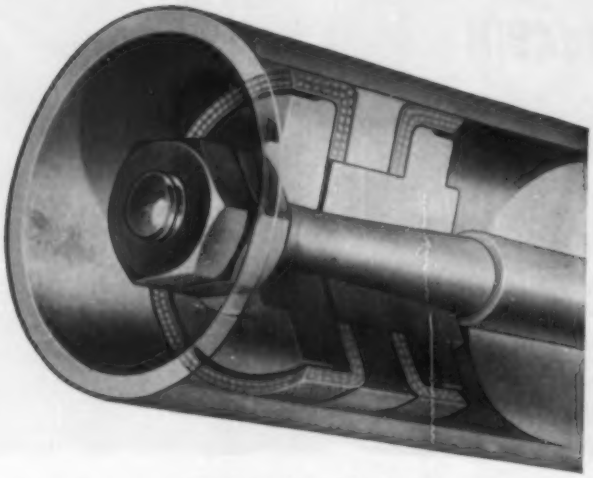
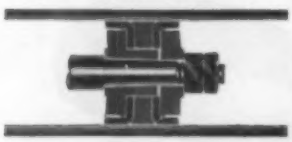
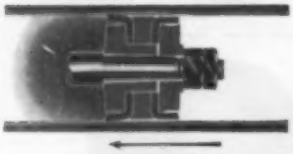


Phantom cutaway showing a typical Pumcup piston assembly.

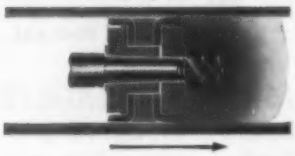
DIAGRAM OF DARCOVA PUMCUP ACTION (greatly exaggerated)



NORMAL: BOTH PUMCUPS RELAXED



UNDER PRESSURE: PUMCUPS SEAL AGAINST CYLINDER DESPITE WEAR, MINIMIZING SLIPPAGE



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DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

Continued from page 66

pressure provides a quick, simple test, and indicates very small leaks. Air flows more easily than oil, and permits a quicker, more sensitive test. In general, manifolds seem to be fairly trouble-free and one company reports going to manifold-type valves in 1½ and 2-inch sizes.

Knowledge is the most powerful tool in troubleshooting.

What hydraulic components should be kept on hand?

All maintenance supervisors reported keeping seals in stock, and most of them have extra cylinders, valves, and pumps. Some tubing or other fluid line is usually available together with corresponding fittings. Some companies stock parts for cylinders, valves, and for pumps such as vanes and rings. Other items that are stocked by some maintenance groups are electric motors, fluid motors, and strainers. Of course the quantity of stock items depends on the number of units in use. A large manufacturer, operating various hydraulic equipment, stocks all standard items including rubber bags for accumulators.

Should hydraulic components be repaired or replaced?

Whether components are repaired or replaced depends to a great extent upon the manufacturer's facilities. The problem is usually decided by considering the cost of the article, amount of work required to complete repairs, and the frequency of breakdowns. Pumps and cylinders are repaired more often than replaced. Valves are replaced about as often as they are repaired, and electrical components are usually replaced though there is a considerable amount of repair that is practical. Defective

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Circle 125

Fiatt, Illinois Mine uses

STANOIL

Industrial Oil in stripper hydraulic jacks for 18 years

At Truax-Traer Coal Company's Fiatt, Illinois, mine, the production goal is 1,000 tons of coal an hour. That's a stiff assignment. It leaves no margin for failure. This indeed applies to the hydraulic jacks of the company's Bucyrus-Erie 950-B stripper. It's the reason STANOIL Industrial Oil has been used as the hydraulic fluid in the four hydraulic jacks since the stripper went into operation in 1937. Eighteen years continuous service is testimony to STANOIL's ability to deliver under any operating condition—heat, cold, rain, dust, dirt.

But there's more to the story than just the ability of STANOIL Industrial Oil to deliver under a wide range of operating conditions. The rest of the story is the Standard technical service provided by men with training and experience.

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Since start of operations in 1937, STANOIL Industrial Oil has been used as hydraulic fluid in Bucyrus-Erie stripper at Truax-Traer Coal Company mine, Fiatt, Illinois. This 950-B stripper is hub of one of the biggest strip mining operations in Fulton County, state's second largest coal producing county.

Bob Wright, Standard Oil lubrication specialist is on the spot to provide technical service on lubrication problems. Bob has a B.S. in engineering from Michigan College of Mining. Before entering field sales work, Bob completed Standard's Sales Engineering School course in industrial lubrication. Customers find this experience and background pay off *for them*.

STANDARD

STANDARD OIL COMPANY

(Indiana)

Continued from page 122

fluid lines are almost always replaced, though there is some repair being done.

Would better information from the manufacturer help the maintenance man?

The answer to this question is very definitely "yes." Maintenance manuals with good hydraulic and electrical schematics can be extremely valuable in understanding machine functions. Manuals can explain machine operation by referring to drawings and schematics. Procedures for difficult or unusual installations can be outlined and illustrated. Troubleshooting charts can be presented to indicate troubles, possible causes, and procedure for test and correction. Parts catalogs which illustrate and list each replaceable part are of great value to the maintenance supervisor when he must replace a machine part. This information may save much correspondence and many service trips by the manufacturer. No maintenance man can remember all the details of complicated machines. Service manuals and parts catalogs are his references. When the operation of a machine is complicated, an operation manual is helpful in training new operators and in indicating various tooling that can be applied to the machine.

What electrical components fail most often?

The durability of electric motors is well known, and they are nearly trouble-free. The most vulnerable electrical components are those used for control—relays and solenoids, though the large number of these helps explain the number of failures. Timers are also among the most frequently failing electrical components, though considering their complexity these have a good service life.

Sometimes the location of electrical components on a machine leaves them open to abuse. Probably the greatest source of limit switch failure is the contamination by chips, coolant, oil, and dirt. Failure of a hydraulic component may in turn cause an electrical failure, and most solenoids fail because of sticking valve spools. Motor starters may fail because of worn, or pitted contacts, though this can be eliminated by periodic inspection and maintenance. In accumulator circuits involving frequent starting and stopping of the electric motor and pump, motor starter contacts are especially subject to wear. In any machine operating on a short cycle, electrical components are more liable to fail.

How can hydraulic equipment be redesigned to decrease troubles and simplify maintenance?

You usually don't have to repair many failures on a machine before you begin getting ideas on how to redesign it. Most maintenance men

Continued on page 126

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S-216-C- 20	150 PSI	20:1	2,100 PSI	210.00
S-216-C- 35	150 PSI	35:1	4,600 PSI	173.25
S-216-C- 60	150 PSI	60:1	6,600 PSI	173.25
S-216-C-100	150 PSI	100:1	8,800 PSI	173.25
S-216-C-150	150 PSI	150:1	15,200 PSI	194.50
S-216-C-200	150 PSI	200:1	23,750 PSI	225.00
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Continued from page 124

have problems of poor access to components or poorly designed installations, though newer machines are better in this respect. Many supervisors have rearranged electrical conduit, so that it does not interfere with access to flanges and fittings. Adjustable components such as pressure switches and flow control valves are sometimes relocated to make them more accessible. Solenoid valves should be equipped with male and female electrical couplers or some simple method of removing the valves without disturbing the wiring. Components should be identified on the machine to correspond with identification on schematic diagrams. One maintenance supervisor responsible for presses, lathes, grinders, and testing equipment has redesigned some of his equipment by panel mounting all units over the reservoir, and many other companies recommend panel mounting of components. The use of tube fittings with seamless steel tubing permitting repeated assembly and disassembly is a remedy. All lines should be properly supported to reduce vibration and fatigue.

Some interesting design practices have been worked out by a large manufacturer of heavy presses. It is recommended that separate drain lines be installed for the hydraulic controls. Sources of air pockets such as upside-down hollow rams, upside-down cylinders fed through the ram, and others should be avoided.

Sectionalizing components and using flange couplings with O-rings rather than pipe fittings simplifies removal and replacement. Changes in oil temperature may produce changes in machine performance and heating units and oil coolers may be provided to maintain desired operating temperature. Providing a liberal tank volume may also help.

How often must seals and packings be replaced?

Most maintenance men wait until a failure occurs before replacing seals and packings, and this depends on the machine operation. In the majority of cases replacements are not made more frequently than once a year and often longer.

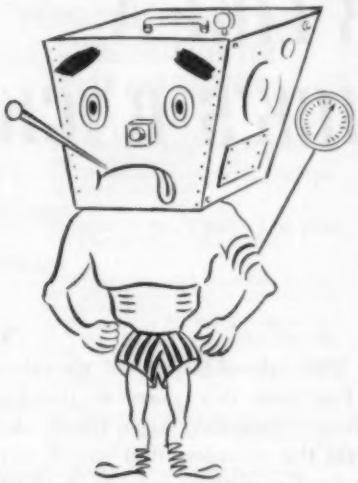
CONCLUSIONS

Every maintenance man develops his own techniques to suit his own machines, but knowing the machine operation is the first step in any maintenance procedure. Generally the troubleshooting procedure should lead to a logical narrowing down of the source of trouble by the process of elimination. The oil level and power source are usually checked first. When the electric motor or control components fail, the first items that should be checked are overload relay heaters in the motor starter, and fuses for the motor and control circuits. But resetting a circuit breaker or replacing a fuse or overload relay heater should not be considered a cure. These are protective devices and give warning that some other fault

Circle 135 on Reader Service Card

exists in the system—either electrical or hydraulic.

Various valves may be operated manually to determine whether the trouble is in the controls or wiring. The pressure at the pump should be checked and then pressures at various stations in the



Temperature and pressure tell a lot about a sick system.

machine sequence. If pressures are correct at some stations and not at others, the component at the point of improper pressure should be checked. Intermittent malfunctioning indicates air or foreign matter in the oil lines or solenoid plungers, broken springs, or sticking valves. Some things to check about the condition of the oil are cleanliness, air, and temperature. If the oil indicates air, the system should be checked for leaks on the suction side of the pump, such as broken pipes or blown gaskets inside the tank. Dirty pump strainers are usually indicated by a noisy pump.

Often it is helpful for hydraulic and electrical technicians to work together. Using the hydraulic and electrical schematics they trace through the circuit functions. The first tests should be those which do not require disassembly, and many checks can be performed with the machine completely shut down. Sometimes an electric oscillograph recording of the pressure fluctuations of the malfunctioning machine during one complete cycle can be compared with a normal machine. On more complex machines, a stroboscopic timing light may be built in to check the timing of various functions. ▼▼▼

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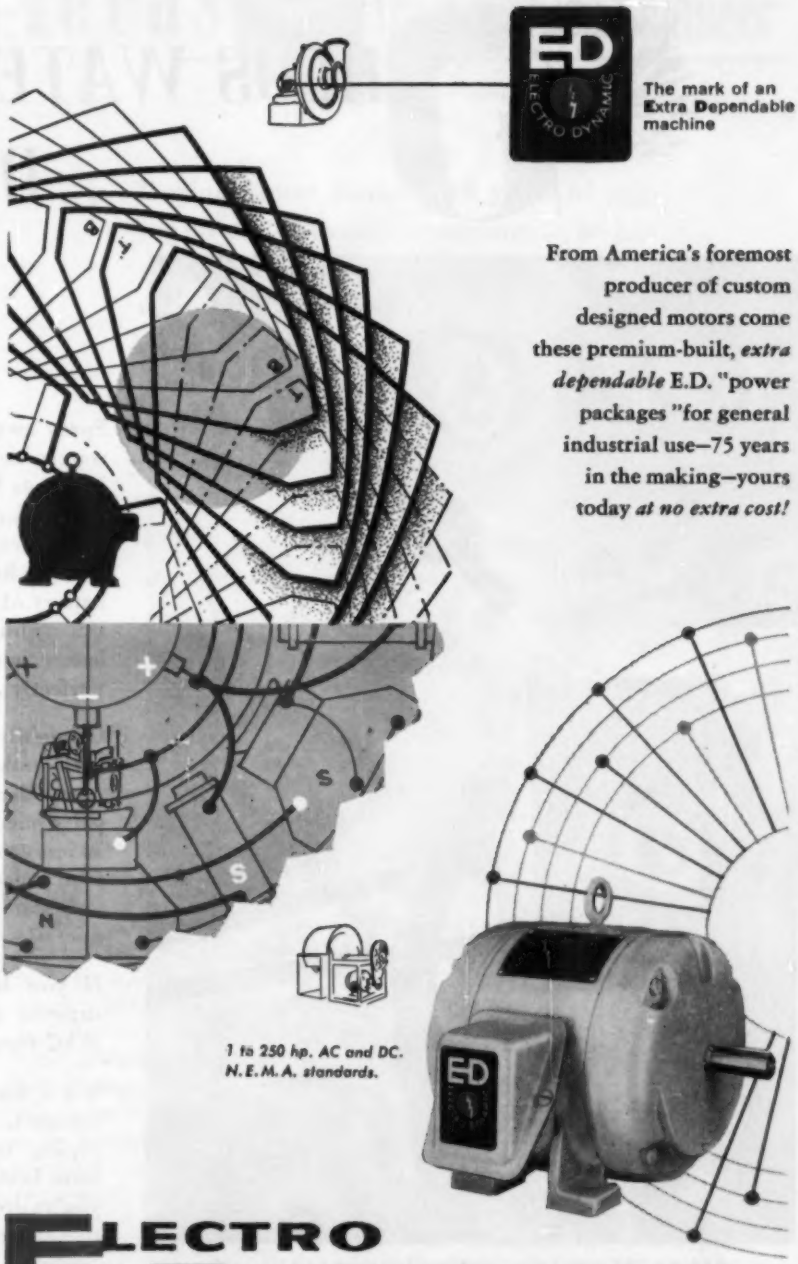

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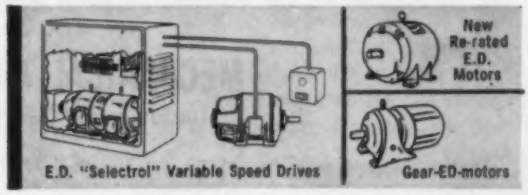

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MAC

Ideas from a Sales Engineer

Elmer F. Heiser

During Elmer Heiser's 18 years of selling air and hydraulic components, he has solved many problems and has left some unsolved. He is the author of the recently published book "*Air and Oil Cylinders in Industrial Applications*". Because we enjoy learning of Elmer's experiences and opinions, we've asked him to write these monthly columns. We hope you too are finding these columns amusing, interesting and informative.

There's More Than Meets The Eye

IN a previous article the practice of separating engineering and maintenance was mentioned. It was pointed out that the designer who works independently of maintenance can easily and unknowingly add to the maintenance burden.

There is yet another separation which often occurs in connection with air and hydraulic problems which causes complications. This is a tendency to isolate from an application those factors which relate directly to air or hydraulic equipment and treat them as separate problems. The procedure in effect narrows the air or hydraulic requirements down to time, travel and control and on this basis develops answers to simple fluid power problems.

There are applications which are so elemental that the factors which relate to air or hydraulic equipment can be picked off and treated as an independent problem. However, it is usually true that there are many other factors which have an important bearing on fluid power decisions. These are so important that they must be recognized as an integral part of the problem, to be juggled, adjusted and reconciled along with the fluid power considerations. Failure to accept these "external factors" as a part of the problem can often lead to unsatisfactory installations.

As an example we can cite from experience an apparently simple hydraulic problem which we helped answer as such, without too much regard for possible "external" monkey wrenches. It was necessary to advance a cabinet, mounted on floor rails at a speed synchronous with an overhead conveyor and return it quickly for the next operation. The cabinet was approximately 3 feet square at the base by 9 feet high and was to move parallel with the conveyor through a 5 foot travel, matching conveyor speeds varying from 3 to 5 feet per minute.

That sounds simple. As the conveyor was overhead, all we had to do was mount a 4-way valve with throttling control on the top of the cabinet and extend an arm for the

Continued on next page

CYLINDER HEADS
HYDRAULIC PRESSURES
HIGH OCTANE FUELS
AIR PRESSURES
VACUUM CONNECTIONS
VAPORS AND GASES
OILS AND SOLVENTS
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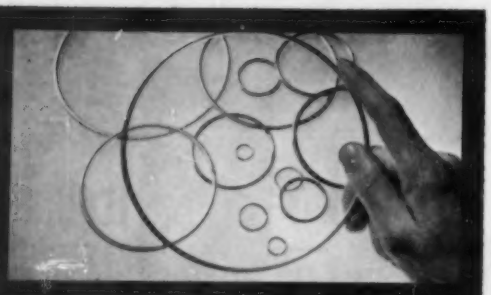

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Ideas From a Sales Engineer

conveyor work hangers to pick up. Why shouldn't the valve open to the required area to keep the cabinet synchronous with the conveyor, when the conveyor work hangers contacted the extended lever?

We mounted the cylinder on the floor to push at the base of the cabinet; placed the valve on top and hung four loops of hose (supply, drain, and two cylinder lines) to complete the installation. On paper it worked very well. Actually it did work after a fashion but not as anticipated.

Several very important "influencing factors" were overlooked in our original solution to the problem. In the first place, the short wheel base of the cabinet in relation to its height meant that any small irregularity on the track, including dirt and chips, caused an amplified movement at the top of the cabinet. In the second place, the work hangers on the conveyor tended to swing slightly due to the nature of the particular operation and the type of parts being processed. Thus we had planted the valve at a point of relative instability and were operating with a lever which "danced" as the conveyor advanced. Instead of opening smoothly to the necessary area to match conveyor speed, the valve was always just a little wrong due to the swing and sway. This caused an uneven cabinet movement which, though noticeable, did not affect the operation seriously.

When it was decided that the conveyor could and should run at 8 to 10 feet per minute our oversight overtook us. Instead of a barely discernable uneveness in movement she really rared up and put on a bucking act. At the higher speed the swing of the work holders was increased, as was the racking and swaying of the cabinet. Obviously the valve could never be in the right position or even near it to match the variables. The valve would open a little, the work swing would open the valve too wide, the cabinet would jump ahead and this forward sway of the cabinet would coincide with a back swing of the

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7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
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6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
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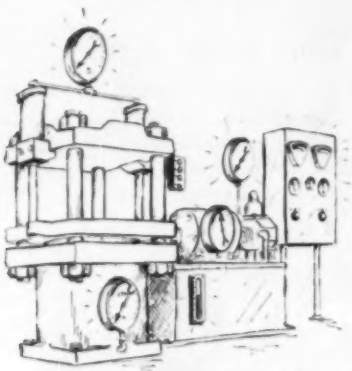
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

work carrier slamming the valve shut, etc., etc.

It was necessary to take a fresh start on the problem approaching this time from the direction of the "external factors." The next answer removed the valve from the cabinet and placed it on the floor along side the cylinder. We used the original extended lever which operated the valve but tied a piece of 1/8 in aircraft cable to it at a point near the conveyor, and raised the contact point of the lever at the work holder to a place where the swing was at a minimum. The other end of the cable was attached to the base of the cabinet and sheaves or pulleys were installed in such a manner



"Now if we can just get it to run."

that initial movement of the operating lever (at the conveyor) "shortened" the cable, opening the valve. As the valve opened, the cylinder advanced the cabinet and cable "payed out" from the other end keeping the valve at a point to synchronize speed.

The second approach, with due consideration for "external factors," eliminated nearly 50 feet of flexible hose and it reduced field piping considerably as the valve was now adjacent to the cylinder. More important however, it resulted in a very satisfactory installation with the same hydraulic equipment which had acted up so miserably earlier.

If a hunk of cable can make so much difference in the operation of a hydraulic installation it might be a good idea, before jumping to conclusions on valves, cylinders, pumps and piping for a job, to take a long careful look to see what "external factors" may upset the apple cart. ▼▼▼

STRATOFLEX
Checks with your Specs
✓AIRCRAFT HOSE
✓HOSE FITTINGS
✓HOSE ASSEMBLIES
The complete line of approved standard weight and light weight aircraft hose and fittings for hydraulic, pneumatic, coolant, fuel and oil systems.
Fittings, Hose and Assemblies in stock or made to your specifications. Write for Aircraft Catalog.
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Circle 66 on Reader Service Card

Backed by more than a century's experience

BRITISH

Hydraulic Plant

& Equipment

LEAD THE WORLD

Particulars of Members and their Products will appear in a future announcement.

The* Hydraulic Association *of Great Britain

•

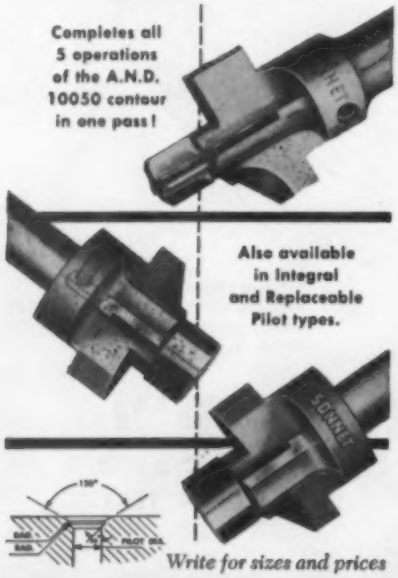
94/98 Petty France, London, S.W.1. England
Telephone: Abbey 1845.

•

Cables: Crusade, Sowest, London

Sonnet A.N.D. 10050 Port Contour Cutter

now available in a NEW Replaceable Reamer Type



Write for sizes and prices

SONNET TOOL and MFG. CO.
571 No. Prairie Avenue • Hawthorne, California

New Products continued

PRESSURE SWITCH

. . . miniature, vibration resistant

Designation: 6300 Series
Features: Switches operate in inert gas and fluids, engine and hydraulic oils, and aromatic fuels. Compact unit permits installation

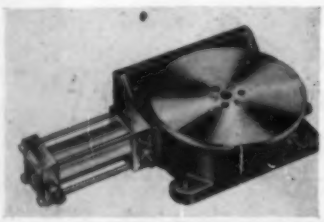
in small areas. Pressure fittings are threaded for bulkhead mounting. Unit is sealed with O-rings to protect against moisture, dust or explosive atmosphere.
Specifications: Operating temperatures range from —65 F to 165 F. Pressures range from 2 to 50 psi. Weight is .32 lb., length 2 inches, diameter 1½ inches.

Southwestern Industries
Los Angeles, Calif.
Circle 158 on Reader Service Card

DIAL FEED TABLES

. . . for indexing operations

Designation: Models 725-EA and 725-EB
Features: Designed for use in areas where space is limited, the



units are capable of indexing on 24 indexes at 300 cycles per minute with a 40 pound load on top of a 7¼ inches diameter plate. Mounting is provided for either horizontal or vertical application and compressed air is available through the center stud for actuation of secondary equipment. Tables can be set for either 4, 6, 8, 12 or 24 indexes per revolution. Model 725-EA is furnished without control valves, Model 725-EB is completely equipped for fully automatic operation.

A. K. Allen Co.
Brooklyn, N. Y.
Circle 159 on Reader Service Card

FLUID JOINT

. . . for rotating cylinders

Operation: Air is fed through two different rotating members in one unit and carrying this pressure to two separate chambers from

which any number of lines can be fed to both the upper and lower air or hydraulic cylinders while in operation. These joints are used as the central air supply to small clamps that operate by clamping at the different stations for assembly.

Rotherm Engineering Co., Inc.
Chicago, Ill.
Circle 160 on Reader Service Card

HYDRAULIC STEERING BOOSTER

. . . has double-tube construction

Designation: Series S22—Model 85 and Model 105
Feature: With the new design

Continued on page 134

a design engineer recently paid us this compliment while examining one of our cylinders. We pass it on to you with the idea that you too may find Pathon cylinders designed right for the job on your cylinder applications.

"It's designed right—just the way I'd do it myself."

As a designer...

YOU GET EVERYTHING YOU WANT IN A HYDRAULIC CYLINDER

Pathon

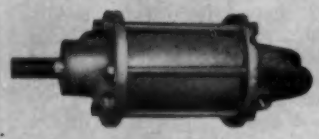
HYDRAULIC CYLINDERS

are made in eight standard models and can be adapted to practically any application. Write us today for Bulletin No. 22. We're glad to help you on any cylinder problem.

- COMPACTNESS
- LOW STRESS CONCENTRATION
- INCREASED STRENGTH ...AND FATIGUE LIFE

All Pathon Hydraulic Cylinders in Series RH 2000 P.S.I. and QH 1000 P.S.I. use a single screw head to attach the head to the body of the cylinder. This design provides an absolute minimum of physical size and at the same time reduces stress concentration throughout the barrel to the head attaching area. You get a *plus factor* in shock loading with increased strength and fatigue life. Your Pathon Hydraulic Cylinders are simple and sturdy in construction, require much less maintenance.

Pathon AIR CYLINDERS



DIRECTIONAL CONTROL VALVES

We also manufacture a complete line of Air Cylinders and Directional Control Valves. Write for information.

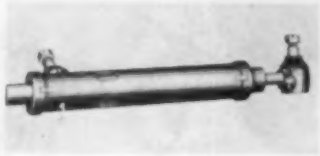
Pathon MANUFACTURING CO.

3823 PACIFIC AVE.

CINCINNATI 12, OHIO

New Products continued

assembly tie rods are eliminated and replaced with end caps which are screwed on and secured with removable tackwelded clips. Annular space between the double cylinder walls is utilized for booster oil flow, avoiding the need for external piping. The inner operating cylinder and other working parts are protected from possible damage by the external tube. Ease of installations and flexibility of application is provided through optional positioning of the booster oil connections.



Specifications: Units are available with either of two piston strokes. Model 85 has maximum stroke of 8½ inches, Model 105, 10½ inches. Both have the same rated thrust capacity of 1500 lb at 600 psi operating pressure. Unit is designed for maximum operating pressure of 1000 psi.

Applications: For tractors and farm machinery, material handling vehicles and other mobile equipment.

Vickers Incorporated
Detroit, Mich.

Circle 161 on Reader Service Card

Why "Superior" (SAE) hydraulic tubing practically eliminates failure in critical hydraulic systems

The production of Superior (SAE) Hydraulic Tubing is carefully controlled from the melting of the steel to the final testing of the finished tube. The steel used is a non-aging type. It will not age harden in storage racks. Carbon content is held to 0.12% maximum (JIC Standards permit 0.18% and SAE Specifications 0.15%).

Mechanical properties more closely approach those of copper than any other steel products. Elongation, for instance, is 35% min. in 2" for tubes of ⅜" x .035" wall and over. This means that the tubing is easily hand bent and flared.

A clean, bright OD-ID finish is the natural result of the cold drawing and bright annealing practice standard at SUPERIOR, and the ends, both outside and in, are deburred. Furthermore, all tubing is thoroughly tested, as the pictures on the right show. Such quality practices give SUPERIOR tubing a tremendous advantage over annealed mechanical or pressure tubing—make it practically troublefree.

The selection of the proper tubing for your application depends on three factors: pressure, velocity and flow. Write for Superior Hydraulic literature. It lists recommended working pressures for Superior (SAE) Hydraulic Tubing and gives you the velocity and flow information needed to calculate the proper ID for tubing used in your equipment. Use the coupon.

TUBING MUST FLARE without difficulty and without forming minute surface notches or breaks. Each order of Superior (SAE) Hydraulic Tubing is tested for flareability.

EVERY SINGLE LENGTH of Superior (SAE) Hydraulic Tubing is 100% hydrostatic tested.

SUPERIOR TUBE COMPANY
2030 Germantown Ave., Norristown, Pa.

☐ Send me free Superior (SAE) Hydraulic literature.

☐ Send me a free sample of hydraulic tubing _____" OD and _____" wall to be used for _____

☐ Send the name and address of the distributor nearest me.

Name.....

Title.....

Company.....

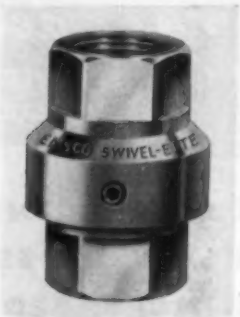
Street.....

City.....Zone.....State.....

SMALL SWIVEL JOINT . . . for air, oil and water

Designation: Swivel-Ette

Features: Designed to rotate 360 degrees, the joint is intended for occasional or intermittent turning rather than for continuous rotation, particularly suitable for hose lines



where flexing and weaving are encountered. Field tests have proved that the fitting is conservatively rated at 300 psi cold working pressure and for temperatures up to 225 degrees F.

Specifications: Made of a special die cast alloy, the unit is made in two styles and is available in ½ inch and ¾ inch internal pipe sizes.

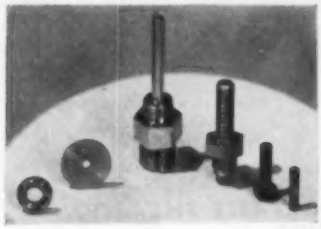
Emsco Manufacturing Co.
Los Angeles, Calif.

Circle 162 on Reader Service Card

TEMPERATURE PROBES . . . have high output

Features: Temperature probes have high resistance of 20,000 ohms. When used with the proper bridge

network they provide an output signal of 5 volts without amplification for as little as a 150-degree temperature change. The probes are



available in various configurations for measuring fluid, surface, structure, air, hydraulic line, cylinder head, and subminiature component temperatures.

Arnoux Corp.
Los Angeles, Calif.

Circle 163 on Reader Service Card

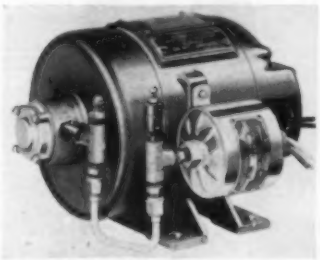
AIR PUMP

. . . for 20 psi pressure

Designation: Model RG-10470

Design: A common shaft transmits motor power to the pump rotor and sliding blades. This integral motor-pump unit uses no seals or shaft packings. Thrust plates and blades made of carbon-graphite composition are self-lubricating.

Features: Pressure switch setting —automatic shut-off under increasing pressure conditions at 20 psi; automatic restart under decreasing



pressure conditions at 18 psi; relief valve setting to crack at 22 psi.

Specifications: Motor is 1/6 hp, at 3450 rpm, 115 volts, AC, 4 amps, 60 cycles, single phase, continuous duty.

Lear-Romec Division
Lear, Inc.
Elyria, Ohio

Circle 164 on Reader Service Card

FEED UNIT

. . . air powered, oil controlled

Designation: DCP-50A

Features: This unit will maintain a pre-set feed rate at virtually

Continued on next page

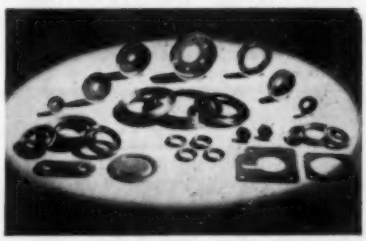
Users prefer

GARLOCK HYDRAULIC PACKINGS

Garlock CHEVRON* Packing • At every pressure, from the lowest to the highest, this popular packing provides a positive, low friction seal. Ideally suited for use on hydraulic cylinders (both single and double acting), hydraulic rams, plungers of pumps and other reciprocating rods.

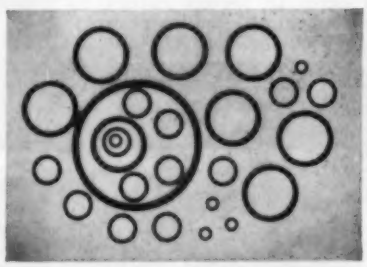
Garlock CHEVRON Packing

Garlock Leather Packings • Cups, "U" packings, "V" packings, washers, gaskets, discs and flange or hat packings, are available for all types of hydraulic service. Specify Garlock BITAN*, a chrome-and-oak-tanned leather, or THIOTAN* a synthetic rubber impregnated leather.



Garlock Leather Packings

Garlock O-Rings • Made to Garlock's rigid quality standards, these O-Rings are manufactured with precise tolerances, a flash-free finish, and utmost uniformity. 70 durometer rubber O-Rings in all popular sizes are available from any of Garlock's branch warehouses.



Garlock O-Rings

Call your Garlock representative or write for information on hydraulic packings, designating for which type, or types, you desire literature.

*Registered Trademark

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Sales Offices and Warehouses: Baltimore • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit • Houston • Los Angeles • New Orleans • New York City • Palmyra (N.Y.) • Philadelphia Pittsburgh • Portland (Oregon) • Salt Lake City • San Francisco • St. Louis • Seattle • Spokane • Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

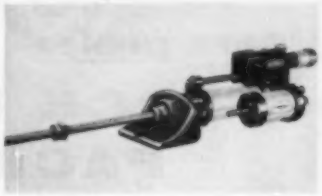
GARLOCK

PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS, RUBBER EXPANSION JOINTS

Circle 50 on Reader Service Card

New Products / continued

100 percent accuracy, unaffected by changes in temperature, load and air line pressure. A liquid filled metallic bellows constantly corrects the flow control valve in accordance with changes in hydraulic oil temperatures. An upstream flow control regulator compensates for variations in load and fluctuations in air line pressure. To break up any minute residual air bubbles in the fluid, a sintered metal filter is incorporated.



Specifications: Available in standard stroke lengths of 2, 4, 6, 9, 12, 15 or 18 inches. Control may be on either forward or retract stroke, or both.

The Bellows Company
Akron, Ohio
Circle 165 on Reader Service Card

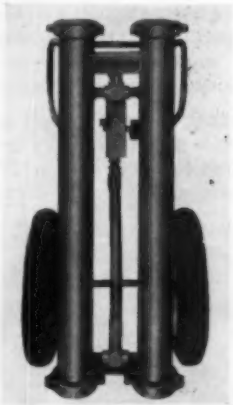
PORTABLE FILTRATION UNIT

. . . provides on the spot filtration

Designation: Filter Buggy

Design: Built to be quickly moved by one man from one machine location to another, the unit provides filtration for all hydraulic systems and machines. It has no motors or pumps but uses hydraulic power furnished by the machine itself. Unit is also available with pump and motor mounted.

Features: A phenolic resin impregnated cellulose filter designed



with radial fins provides a filter area of 13,944 square inches. Filtering time is governed by the gpm of the machine pump and the amount of oil in the machine reservoir. Connections are made by quick disconnect couplings. Relief valves with a maximum pressure differential of 40 psi protect the filter element. This unit will not filter out oil additives nor chemical or water base flame-resistant fluids.

Schroeder Brothers
Pittsburgh, Pa.
Circle 166 on Reader Service Card

PNEUMATIC SILENCERS

. . . easily attached

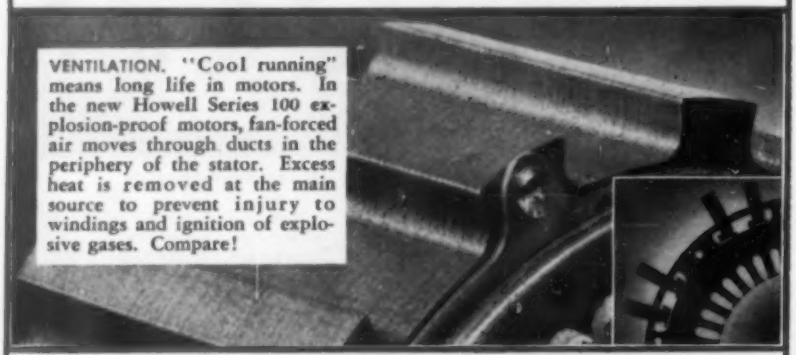
Designation: Quietaire

Features: These units, of all-metal construction, eliminate noise-shock

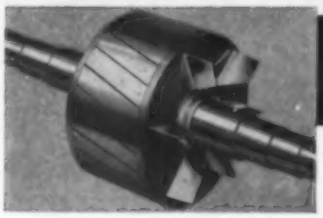
To hydraulics engineers, Howell suggests

What to look for in explosion-proof motors

Beyond an enclosure for containing an internal explosion effectively, you want the most dependable and lasting motor you can get. Below are some points for comparison . . . and two of the many "bonus" features of the new Series 100 Howell explosion-proof motors. Series 100 and the more conventional Type EK motors together offer a range of sizes from ½ to 50 H.P.



VENTILATION. "Cool running" means long life in motors. In the new Howell Series 100 explosion-proof motors, fan-forced air moves through ducts in the periphery of the stator. Excess heat is removed at the main source to prevent injury to windings and ignition of explosive gases. Compare!



COPPER-CLAD ROTORS. All Howell motors have copper-clad rotors. This means better heat conductivity (91% greater than aluminum's) stability at high temperatures and, as opposed to die-cast rotors, greater flexibility to meet your special requirements. Compare!

HOWELL MOTORS

HOWELL Red Band MOTORS

from air-operated equipment. The silencers have no cartridges, are

corrosion resistant and are safe for any pressure normally encountered in industrial pneumatic service. Compact and easily attached, they will fit practically all industrial air operated equipment. Silencers are available in four models.

C. W. Morris Co.
Detroit, Mich.

Circle 167 on Reader Service Card

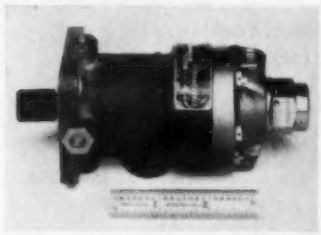
HYDRAULIC PUMPS

. . . have high horsepower-to-weight ratio

Designation: Series 65

Features: Of compact, lightweight design, these positive piston return type pumps are available in both constant delivery and variable delivery models. The pumps deliver fluids through a wide range of altitudes and speeds without pressurization. Rated at 1500 rpm, they have excellent pumping characteristics at speeds up to 10,000 rpm and inlet pressures equivalent to 65,000 feet altitude.

Specifications: Constant delivery models are available in sizes from



0.5 gpm to 3.0 gpm; the variable delivery models from 0.25 gpm to 1.0 gpm. The 0.5 gpm constant delivery pump weighs only 31 oz and weights of the other sizes are correspondingly low.

Applications: For aircraft and missile applications and uses requiring high speed operation with extreme space limitations.

The New York Air Brake Co.
Watertown, N. Y.

Circle 168 on Reader Service Card

Continued on next page

Circle 134 on Reader Service Card

TRUE-TRACE
HYDRAULIC TRACER CONTROLS

Application Engineering — Installation

TRUE-TRACE

Tomorrow's Tooling Techniques TODAY!

Specify machine tool application when requesting informative literature.

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MARSH *Mastergauge*

Always the best of the better gauges, Mastergauge has been given *plus* features that further lengthen its lead.

A still better tube construction: Socket, tube and end piece are now all fused into *one* leak-tight unit by the new Marsh "Conoweld" process.

A still better case: New copper clad wrought steel "Marshalloy" case has the corrosion resistance of pure copper; weighs one third as much as cast iron, and is *four times* as strong.

An even finer movement: Further refinements are added to the rugged, corrosion resistant, virtually frictionless stainless steel and monel Mastergauge movement. A typical refinement is the "coined" (extruded) sector gear which contributes extra strength and precision.

Where only the best is good enough—in the most critical industrial refinery and oil country services —"Mastergauge" is your instrument.

WRITE FOR NEW CATALOG

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Simple Units
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No Distortion
Instant Clamp Release

For MILLING GRINDING WELDING GLUEING
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Circle 109 on Reader Service Card

New Products continued

BRAKE MOTORS

. . . built to rerated NEMA specifications

Design: Rugged cast-iron frame now encloses more horsepower in less space, is heat-seasoned to prevent warpage. Motor features use-

fulness of quick-stops and positive holding, a throughshaft extension for hand cranks. A direct acting magnetic disc brake is used which can be connected either directly to the motor terminals or to a separate power supply. As a safety measure the brake will set and hold in the event of power failure or low voltage by means of mechanical spring action.

Specifications: Ratings are from 1 to 30 hp. The motors are available with standard, undersize or oversize brakes.

U. S. Electrical Motors Inc.
Los Angeles, Calif.
Circle 169 on Reader Service Card

HYDRAULIC CYLINDERS

. . . from cold-drawn electriweld steel tubing

Features: Using improved processing techniques, this tubing can carry heavy torsion loads. It resists high frequency vibration and has a favorable weight-to-strength ratio in applications in which the loading is in all directions. For high-quality inside surfaces and close control of outside and inside tolerances the tubing is drawn over a mandrel and through a ring die simultaneously. The mirror-like inside surface finish makes this suitable, without honing, for many cylinders requiring a superior finish and close tolerances.

The cold drawn tubing is produced in sizes ranging from ¾ to 2¼ inches O.D. Wall thicknesses range from 0.035 inch minimum to 0.134 inch maximum.

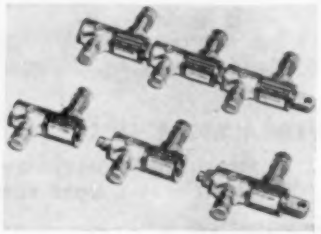
Jones & Laughlin Steel Corp.
Pittsburgh, Pa.
Circle 170 on Reader Service Card

SWIVEL JOINT

. . . for aircraft applications

Designation: Roto-Mite

Features: A pressure balanced, low torque swivel joint which



eliminates the need for bearings or other anti-friction parts. Several

Continued on page 140

AIR

This Inexpensive, Lightweight Pneumatic Power Source Can Simplify YOUR Hydro-Pneumatic Automation or Processing Problem

MODEL 130R1401
WEIGHT 79 Lbs.
ENVELOPE 14 x 14 x 24 In.

Cornelius

PORTABLE COMPRESSOR
Rating 3000 Pounds Per Square Inch
2 CFM Free Air

Cornelius Portable Air Compressors provide dry, clean air for every high pressure low volume requirement. Four models available. Electric or gasoline powered. Complete and ready to operate.

WRITE FOR PRODUCT SHEET #5A

THE CORNELIUS COMPANY • **550—39th Ave. N. E.**
Minneapolis 21, Minn.

POWER

HAND HYDRAULIC PUMP

Single and Double Designs to 20,000 PSI
With or Without Reservoir
Standard Reservoirs
70- 160- 910-Cu. In. Capacity
Interchangeable Pistons
⅜ - ½ - ¾ Inch
1-inch Piston (Special)
Pipe connections ¼" N.P.T.
Handle length is 18 inches.

"We specialize in hand pump units to operate in temperatures from minus 65 F to plus 160 F and with any capacity reservoirs required."

The single pump with ½" or ¾" piston now available in stainless steel.

WILLIAM S. PINE
1635 E. 22nd St., Los Angeles 11, Calif.

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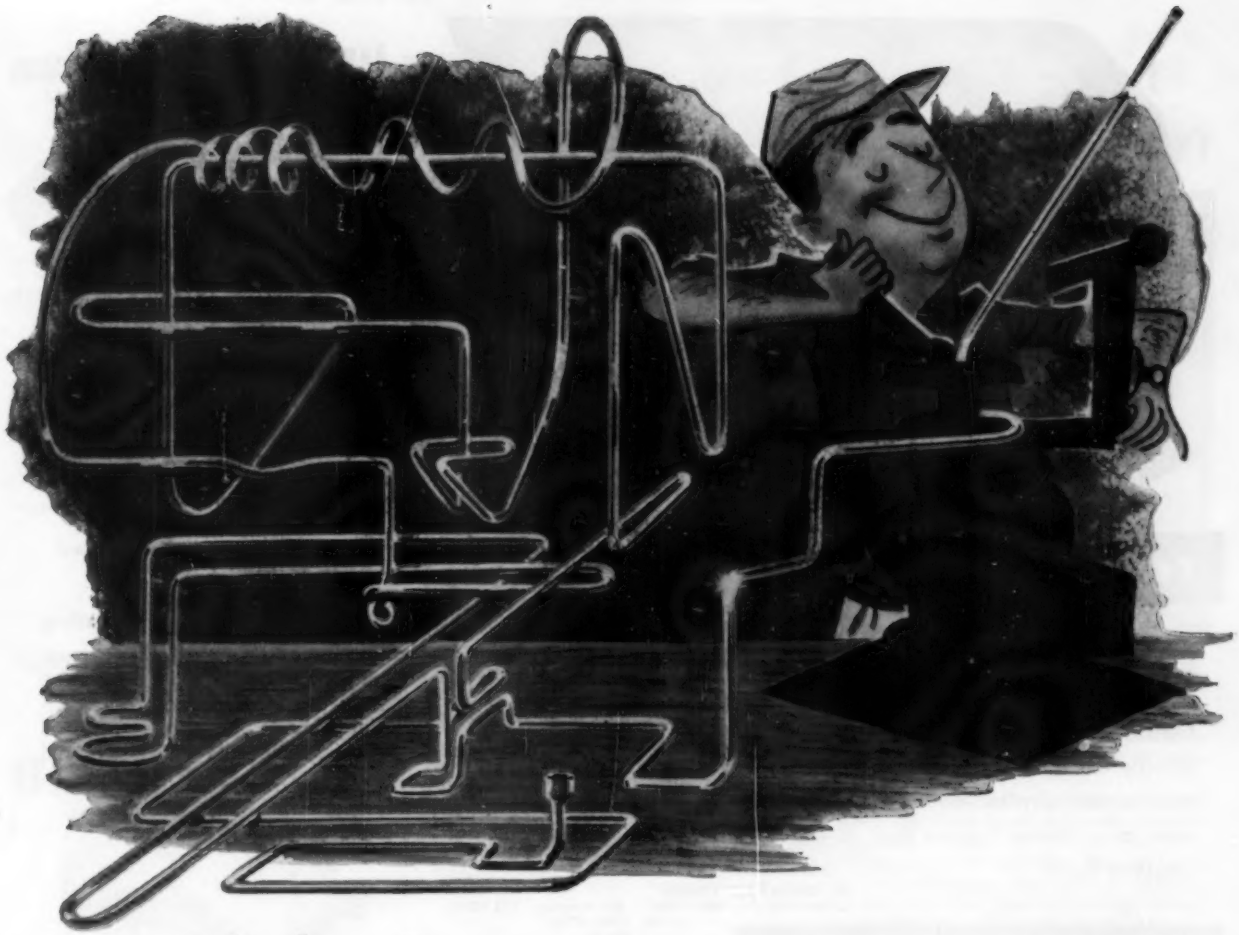
Circle 107 on Reader Service Card



No Hydraulic Tubing job's too tough for us!

What's your hydraulic tubing problem? Unusual shapes? Special sizes or specifications? Whatever your problem, we're in a position to help you in a special way.

Our research, production and sales teams are small enough to give you the kind of personalized service that gets results when nothing else can. And they're big enough to get volume production going in a hurry on the special tubing you need.

Our modern plant is flexible, versatile and completely equipped to produce almost any type of cold drawn seamless tubing you can name—and produce it to *your* specifications. What's more, every operation at Summerill is laboratory controlled to give you consistent peak quality of product with every tube.

Why not let us tackle *your* hydraulic tubing problems? We'll welcome the opportunity to show you how Summerill Seamless Tubing can improve product quality and reduce costs. Address: Summerill Tubing Division, Columbia Steel & Shafting Co., Pittsburgh 30, Pa.

W&D 5478

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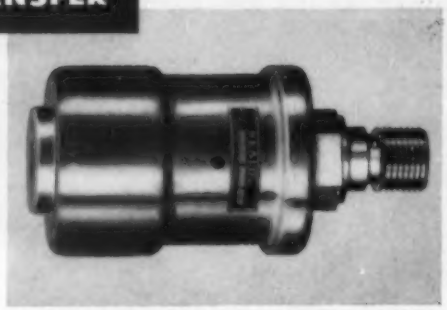
HOW TO PUT A TWIST IN PRESSURIZED FLUIDS

If your new designs or present equipment call for the transfer of pressurized fluids from a stationary source to a rotating part, Sealol Fluid Transfers (designed for use on hollow shafts or spindles) are the answer.

Type EL FLUID TRANSFER

. . . a medium pressure, high speed unit. Attachment is made at the shaft end for transfer of oil, air, etc. to actuate clutches, power cylinders, and similar equipment, or to deliver coolant to machine tools.



EL OPERATING LIMITS:
Liquid Pressure: 500 PSIG • Air Pressure: 100 PSIG.
Speed: 5,000 RPM.
Temp.: 200°F.

Type EH FLUID TRANSFER

. . . a high pressure unit used on applications similar to those of the EL Type. Axial thrust is balanced out, permitting higher speeds and pressures.

EH OPERATING LIMITS:
Liquid Pressure: 1,000 PSIG. • Air Pressure: 100 PSIG.
Speed: 10,000 RPM.
Temp.: 200°F.

Contact Sealol today for further information on uses and applications of Fluid Transfers . . . or submit your transfer problems for engineering data and recommendations.

Sealol Corporation, 181 Post Road, Providence 5, Rhode Island

New York • Philadelphia • Chicago • Cleveland • Dallas • Houston • San Francisco • Los Angeles • Charleston (W. Va.) • Norfolk • Seattle • St. Louis • Tulsa • Edmonton Toronto • Montreal (Can.) • Manchester (Eng.) • Paris • Frankfurt.

SEALOL

THE BALANCED PRESSURE SEAL

Circle 119 on Reader Service Card

New Products / continued

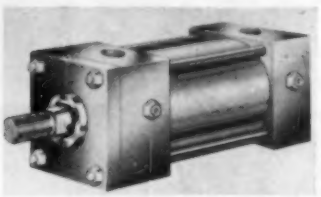
stocked assemblies can be selected and snapped together to make up different integral unit arrangements for various installations and mounting conditions. Piping fatigue may be completely eliminated by a means of rotating the shaft with a link from the articulated cylinder or surface. Swivels can be made from steel, aluminum or titanium, and can be adapted for a variety of uses.

The Weatherhead Company
Aviation Division
Antwerp, Ohio

Circle 171 on Reader Service Card

AIR CYLINDERS
. . . offer 21 types of mounting

Features: Designed to JIC standards, this line of cylinders feature brass tubes, removable bronze cartridge containing wiper and rod packing, and cold rolled steel end



plates. Pistons and tie rods are secured with lock nuts. On cushioned models, cushions float on an O-ring for accurate self-alignment. Cylinders can be supplied with either single or double end rods.

Sizes: Available in 11 bore sizes from 1½ to 14 inches.

The S-P Manufacturing Corp.
Cleveland, Ohio

Circle 172 on Reader Service Card

SYNTHETIC COMPOUND
. . . resists swelling and shrinking

Designation: WJ-70

Features: Developed to produce "O" Rings which resist swelling or shrinkage in many normally destructive organic fluids. Suitable for use in diester lubricants (MIL-L-7808), high temperature hydraulic fluids, most types of petroleum base fuels and lubricating oils, organic phosphates and many halogenated fluids and solvents.

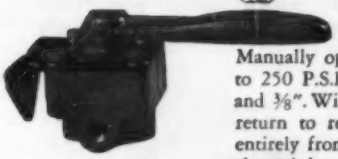
Linear, Inc.
Philadelphia, Pa.

Circle 173 on Reader Service Card

Continued on page 142

Circle 14 on Reader Service Card

NEW 'SHEAR-SEAL' AIR VALVE



Manual 4-Way Valve

DESCRIPTION:

Manually operated 4-way valves for up to 250 P.S.I. air service. Port sizes ¼" and ⅜". With or without return (spring return to reverse or to center). Made entirely from corrosion resisting materials; stainless steel, bronze and aluminum.

With Spring Return

FEATURES:

Millions of service-free cycles even on *unlubricated* air. Leakproof to the end because "Shear-Seals" improve with use, cannot be scored or held open by dirt or pipe scale. Excellent throttling characteristics. Flexibility of porting and integral mounting bracket reduce installation cost.

COST:

$18.50 list price for a ¼", $19.50 for a ⅜" valve, less the usual trade and quantity discounts. Add $1.00 for spring return. Buy and try one on a money back guarantee, or write for complete literature 2801.

BARKSDALE VALVES

5125 ALCOA AVENUE, LOS ANGELES 58, CALIFORNIA

---

3 in 1 GUARD of the AIR LINE

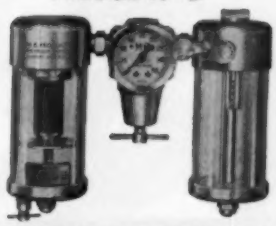
M-B

WHIRL-A-WAY

FILTER-REGULATOR and LUBRICATOR ASSEMBLY

MODEL W-3

the BEST PROTECTION TO YOUR AIR-VALVES, CYLINDERS, PNEUMATIC TOOLS, ETC.



The FILTER removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR capable of passing large volume with unrestricted flow and minimum pressure drop. LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

ANY OF THESE 3 DEVICES CAN BE USED AS SEPARATE UNITS OR IN ANY COMBINATION

WRITE FOR LITERATURE

M·B PRODUCTS

46 VICTOR AVE., Div. 10
DETROIT 3, MICHIGAN

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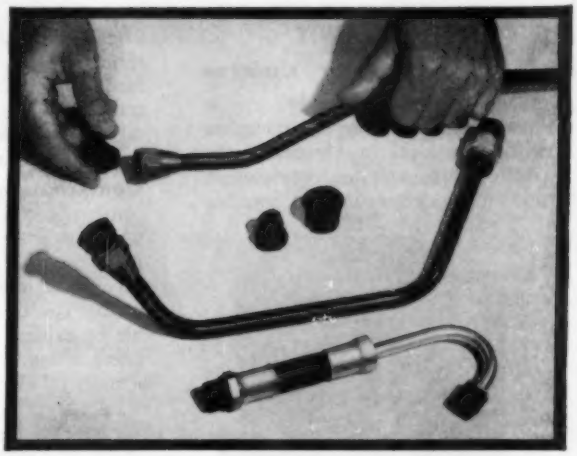
can CaPlugs protect your products this same way?



Look how Anchor Coupling Co., Inc. uses these tough, flexible closures to protect threads and seal assemblies from dirt during storage and shipment.

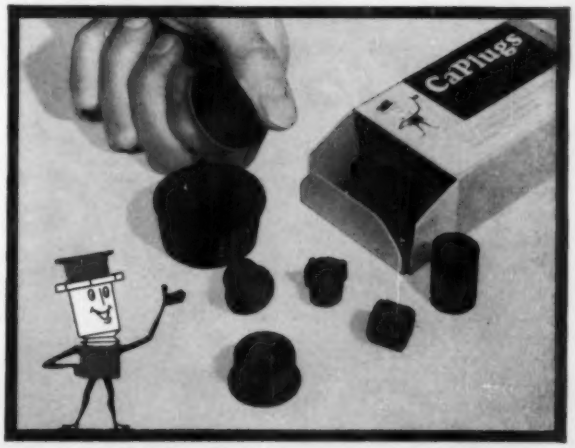
Says Anchor, "We are sure that assemblies will arrive in our customers' hands in the same clean condition as when they passed our final inspection."

Made of Polyethylene, CaPlugs will not collapse, chip, break or shred . . . are impervious to all common chemical reagents, acids and solvents.

Furnished in six standardized cap and plug designs (both threaded and non-threaded), CaPlugs are regularly used by hundreds of industries on numerous types of tubing, valves, hydraulic components, fittings and machined parts.

Stocked in over 200 sizes (up to 8" in dia.), CaPlugs are readily obtainable to protect your products profitably, too!

find out by writing for this FREE assortment



CaPlugs

DIVISION

PROTECTIVE CLOSURES CO., INC.

2209 ELMWOOD AVE. BUFFALO 23, N. Y.

Circle 87 on Reader Service Card

Circle 111 on Reader Service Card

New Products continued

OIL FILTERING UNIT

. . . filters to within ½ micron

Designation: Hydra-Filter

Features: The unit is complete with a gear pump, electric motor, control panel with necessary gauges, flow meter, reservoir and connecting lines. Reservoir and all piping are non-corrosive. The filtering system includes one comb type, one magnetic type and seven micronic disc type filters. In addition to filtering the unit can also be used for flushing hydraulic systems, for the transfer and handling of hydraulic oil directly from drums and for test operating hydraulic systems.

Construction: Basic structure consists of a metal frame upon which all components are mounted. All parts of the unit are easily accessible for adjustment and maintenance. The control panel is accessible by raising a hinged cover. The unit's three wheels have helical springs to absorb shock.

Farnham Manufacturing Div.
The Wiesner-Rapp Co., Inc.
Buffalo, N. Y.

Circle 174 on Reader Service Card

PUSH BUTTON ENCLOSURES

. . . are oil tight

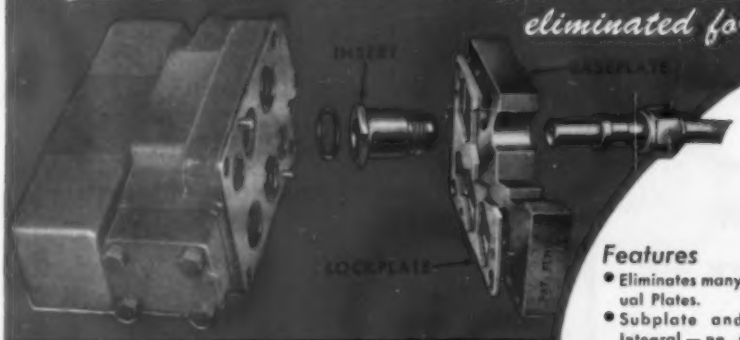
Construction: Fabricated from 14 gauge steel, these enclosures have two external mounting feet for use in any position, vertical or horizontal. The cover with a sponge neoprene gasket is fastened to the box by four nickle plated captivated screws which thread into closed tapped holes located in the box flange. The cover can be easily swung open for easy wiring. Push button openings are located on 2¼ inch centers and are shaped to accommodate any standard make of control unit while retaining an oil tight seal.

Sizes: Ten standard sizes for 1, 2, 3, 4, 6, 9, 12, 16 and 25 control units are available.

Hoffman Engineering Corporation
Anoka, Minnesota

Circle 175 on Reader Service Card

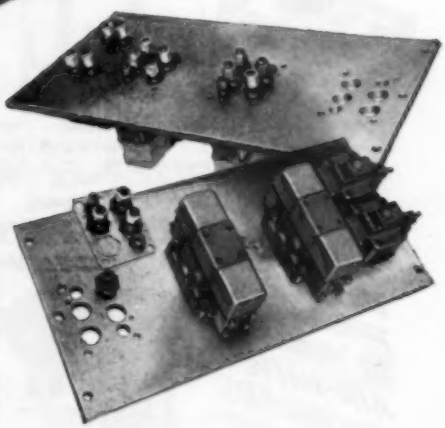
Hydraulic Panel Pipe Thread Leaks
eliminated for you!



THREADLESS SUBPLATES FOR INDIVIDUAL VALVE MOUNTING

Features

- Eliminates many Individual Plates.
- Subplate and Panel Integral — no separate mounting panel.
- Standard Inserts and Lockplates used.
- Base plate contains no pipe threads and is not subject to direct hydraulic pressure.



THREADLESS SUBPLATES FOR MULTIPLE VALVE MOUNTING

Insert	Lockplate	Baseplate
Standard part — same as used with individual mount-	Standard part to suit each valve to be mounted.	Hot rolled steel plate— Number and arrangement of valves to suit your application.

Applications—For all Gasket Mounted Valves

DETCH

Factory
Alpena, Michigan

Circle 106 on Reader Service Card

TIME DELAY RELAY

. . . permits electrical interlock

Designation: Model NEL Agastat
Features: Time delay of the unit is pneumatically controlled and provides a readily adjusted and accurate timing interval from 0.1 seconds to 10 or more minutes. The electrical interlock in a circuit which permits pushbutton control is obtained by use of an instant action auxiliary switch. Affixed to the front of the unit is a normally closed double-throw micro-switch. Contacts of this switch are kept in open position by a lever connecting the auxiliary switch and the core of the Agastat. When the coil is energized, the core jumps up and these contacts close instantly, allowing interlock.

Specifications: Available for all AC and DC voltages. The unit which measures 2½ inches wide, 3⅜ inches deep and 4½ inches high, is rated 15 amperes at 115 volts, 60-cycle AC.

AGA Division, Elastic Stop Nut Corporation of America
Elizabeth, N. J.

Circle 176 on Reader Service Card

ROTARY ACTUATOR

. . . for remote valve control

Features: An internal helix arrangement converts the in-line motion of a hydraulic or pneumatic cylinder into a rotary movement. The unit can be operated with air, hydraulic or gas pressure. The actuator can be designed to produce any reasonable degree of rotary movement desired from 0 degree to 360 degrees or more if necessary by increasing the overall length of the helix piston rod assembly. The unit is completely enclosed. Mounting brackets for all makes of valves are available. A wide range of inch-pound torque requirements are met with five standard models.

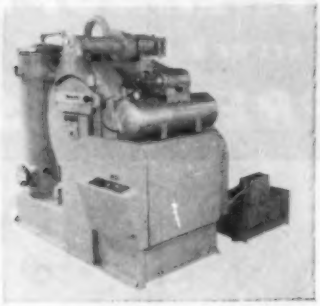
Carter Controls, Inc.
Lansing, Illinois

Circle 177 on Reader Service Card

AIR COMPRESSOR

. . . delivers oil-free air

Design: Use of specially constructed graphite or carbon piston rings instead of conventional steel rings eliminates the need of oil for lubricating the cylinder walls. Motor and compressor are direct-coupled and each cylinder is equipped with a safety overload valve.



Features: Instead of one central

Continued on next page

PETCH CYLINDERS

NC-1 Standard
Heavy Duty Air
200 psi

A rugged Air Cylinder to perform under your most severe operating conditions — Stamping Plants, Foundries, Welding Equipment Manufacturers and many others standardize on this Cylinder to cut maintenance costs.

5 Standard Mounts
PF—Foot Mount
PC—Clevis Mount
PT—Center Trunnion
PB—Blind End Flange
PR—Rod End Flange

Features
- Steel Heads
- Oversize Piston Rod
- Long, Filleted Rod Thread
- Double Ports, each Head
- Interchangeable Cushion Screw & Ball Check
- Full 5:1 Safety Factor at Rated Pressure

Original PETCH features . . .
- Cartridge Type—Rod Wiper, Seal and Bearing Group
- Floating Cushion Bushings assure reproduceable cushion action
- Interchangeable Mounting Parts

Note: Readers Reference Card for both Subplates and Cylinders—

MANUFACTURING COMPANY 463 York, DETROIT 2

Circle 113 on Reader Service Card

for production brazing...

LUCAS MILHAUPT
SILVER BRAZING
PREFORMS

RINGS
Round Wire, Machine Wound, Mandrel Wound.

RINGS
Flat Wire, Machine Wound, Mandrel Wound.

ODD SHAPES
Any size or form.

WASHERS
Edgewound and Blanked.

Preforms in any size or shape that...

1. End Wasted Time In Placing Silver Solder in position for brazing.
2. Speed Assembly Work.
3. Eliminate Rejects.
4. Meter Silver Solder to Flow In and Around Joints.

To do your silver brazing job better, Lucas-Milhaupt offers a wide range of silver brazing preform sizes and shapes. In addition to round and flat wire rings, blanked and edgewound washers, Lucas-Milhaupt provides a complete line of preforms which include such shapes as elliptical, rings, hinged rings, segments, slugs, U clips, hairpins, etc. Send your drawings or sample part and the proper preform will be designed to do your brazing job faster at less cost.

FREE... 16 page booklet gives you all the facts on better brazing with preforms. Write Today!

LUCAS MILHAUPT ENGINEERING COMPANY

5052 SOUTH LAKE DRIVE • CUDAHY, WISCONSIN

New Products continued

compressed air station supplying air for several industrial duties, these individual motor driven compressors could be mounted right where the air is needed. Portability of unit and delivery of free air makes it adaptable to all types of control systems and pneumatic tools.

Specifications: Compressors are rated for continuous operation at 35, 75, and 175 psi, and from ¼ to ¾ hp.

Bell & Gossett Company
Morton Grove, Ill.

Circle 178 on Reader Service Card

VACUUM PUMP
. . . redesign reduced height

Features: Reduction of 33 percent in overall height and an increase in vacuum to as low as .4 mm mercury absolute, has been obtained by a newly designed, more efficient automatic oiling system placed under the pump. This redesign of the straight wing rotary air pump has been accomplished without any change in the length of steel wings or area of piston space. When used for pressure these pumps provide a range of 15 to 20 psig.

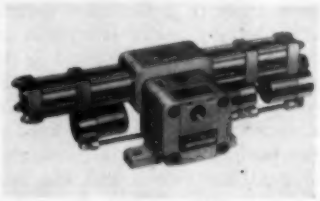
Leiman Bros., Inc.
Newark, N. J.

Circle 179 on Reader Service Card

4-WAY VALVE
. . . has 3-position power attachment

Designation: Model PON

Features: Designed for remote control and automatic operation, the valve embodies the rotating disc construction. Integral disc and stem provide maximum rigidity and durability. Body and disc are lapped to optical accuracy for perfect seal.



Construction: This model has a molybdenum alloyed semi-steel body for freedom from body leaks and features a chrome-plated surface in body for smooth action.

Ledeen Manufacturing Co.
Los Angeles, Calif.

Circle 180 on Reader Service Card

MICRONIC FILTER
. . . for 1000 psi hydraulics

Designation: #56670

Features: Capable of filtering micronic size particles from hydraulic fluids at operating pressures of 1000 psi, the new filter handles flow rates of up to 75 gpm. Made of resin-impregnated paper, the filter element is easily replaceable by removing the snap ring. Case is of all steel construction and contains an "O" ring seal in its head. 1½ inch connections are at either end of case.

Applications: For use on large hydraulically operated machine tools requiring the fluid pressures and flow rates necessary for high speed operation.

Purolator Products, Inc.
Rahway, N. J.

Circle 181 on Reader Service Card

Circle 65 on Reader Service Card

"Wipe out" PACKING FAILURES WITH Seal-Guard METALLIC ROD WIPERS

Self-adjusting, easy to install, Seal-Guard's knife-like bronze rings "wipe off" all dirt and grime, will not mar the rod, are oil and heat resistant and friction-free.

HOW SEAL-GUARD WORKS

1. Twin wiper rings are mounted on rod with notches staggered.
2. Cushion ring is compressed on assembly exerting constant inward pressure keeping ring in constant contact with rod.
3. Harmful substances are completely cleared by scraper action.

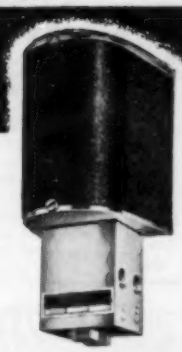
Seal-Guards are available to fit rod diameters from ¼ to 24 inches. Other sizes by special order.

WRITE FOR DESCRIPTIVE LITERATURE.

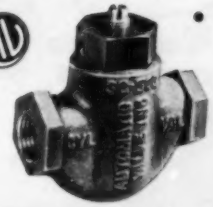
HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

Circle 11 on Reader Service Card

Solenoid VALVES

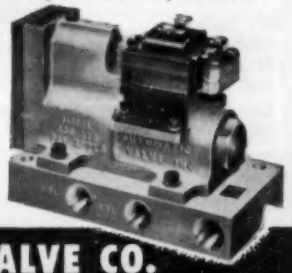


PILOT VALVES
3-WAY 4-WAY
For operating Master Valves and Small Cylinders



Speed Control VALVE
Controls speed of Air and Hydraulic Cylinders

3-Way and 4-Way VALVES
Pilot Operated
Sizes ¼" — ⅜"
½" and ¾"
Write for Bulletin



AUTOMATIC VALVE CO.
37423 GRAND RIVER AVE., FARMINGTON, MICH.

DESIGNED FOR THE JOB

FLOOR SPACE 48"x54"

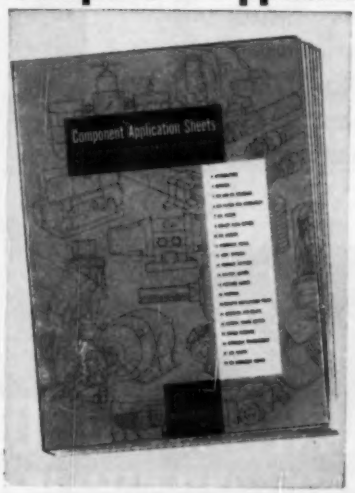
50 TON DUAL RAM
SPECIAL ASSEMBLY PRESS
FOR JET PRODUCTION PARTS

Featuring . . . Manual control of tonnage and rapid ram travel

BUILT FOR THE JOB BY

CENTURY HYDRAULICS, INC.
8866 GREENFIELD — DETROIT 28, MICHIGAN

Component Application Sheets



This 32 page booklet describes air and oil components.

It tells:

- where they're used
- size range
- how they operate
- construction

Provides an excellent training aid.

INDUSTRIAL PUBLISHING GROUP
1240 ONTARIO ST., CLEVELAND 13, OHIO

Please send me.....copy(ies) of "Component Application Sheets" at 50 cents each. Check is enclosed.

Name .....

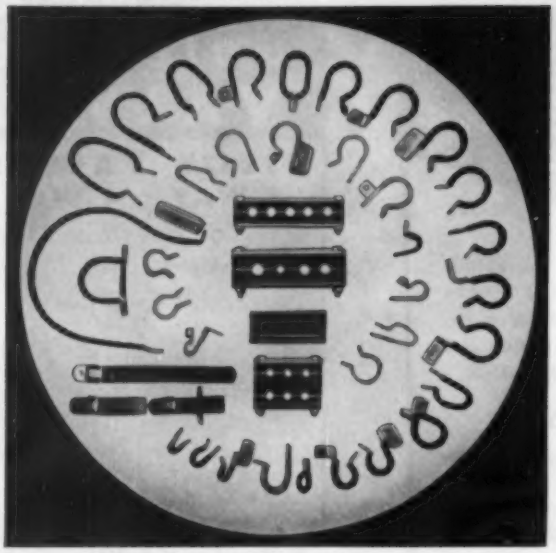
Street .....

City ..... State .....

Circle 21 on Reader Service Card

Circle 3 on Reader Service Card

Cost Saving Ideas...



15,000 different types and sizes of LINE SUPPORT CLIPS, LINE SUPPORT BLOCKS and HARNESS STRAPS for positive, vibration-free support in aircraft, marine and industrial installations.

Consider the advantages of standardization — completeness of line — a smaller and more flexible inventory — quick and easy training of personnel — safety — durability — interchangeability — ECONOMY ... Specify ADEL

Complete Catalog available upon request

ADEL
PRECISION PRODUCTS
A Division Of
General Metals Corporation

Direct inquiries to Huntington Division
1444 Washington Avenue
Huntington 4, West Virginia
Burbank, California
Canada: Railway & Power Engineering Corporation, Limited

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH

The New
CAPITAL HYDRAULIC OIL FILTER
WITH MONEL METAL INSERT
Reservoir Type for Hydraulic and Oil Re-Circulating Machinery
EASY TO INSTALL • EASY TO CLEAN • LONG LIFE • LOW COST
SIZES AND SCREENS TO FIT YOUR NEEDS

CAPITAL ENGINEERING & MFG. CORP.
5837 South Ashland Avenue Chicago 36, Illinois

Useful Literature / continued

HYDRAULIC POWER STEERING . . . its performance and installation is presented in literature available from Westinghouse Air Brake Company, Industrial Products Division. The unit can easily be installed on existing off-highway equipment without any design changes. Full 360 degree power steering is possible even with engine idling. All operating parts are totally enclosed and sealed against damage from dirt and weather. In the event of loss of oil pressure vehicle instantly reverts to manual steering.

Circle 217 on Reader Service Card

4-WAY VALVES . . . Designated Bulletin 8344, these new 4-way dual and single solenoid valves are designed for safe and dependable control of double acting pneumatic or hydraulic cylinders. Fast acting, up to 850 cycles per minute, the valve will perform in air, hydraulic fluid and water applications from 10-500 psi. The single solenoid valve—equipped with one solenoid, the main valve operates when the solenoid is energized. The dual solenoid valve—equipped with two solenoids, the main valve operates when one solenoid is energized and remains in position when the power to the solenoid has been disconnected. Flow diagrams of both units and complete dimensions are given on a data sheet available from Automatic Switch Co.

Circle 218 on Reader Service Card

AIR MOTORS . . . and their interchangeable valves are featured in an attractive 8 page bulletin ML-3, prepared by The Bellows Company. Colorful illustrations show the many typical applications where controlled air powered devices have been profitably installed. The booklet also contains complete descriptions and illustrations of such standard items as valves and cylinders, drill press feeds, hydro-checks, vises, index tables and self contained drilling units.

Circle 219 on Reader Service Card

BELLOWS AND FLEXIBLE METAL HOSE . . . To assist the designer in the selection of bellows or metal hose, Flexonics Corpora-

Continued on page 148

ANNOUNCING THE NEW LINE OF PALLEY HYDRAULIC CYLINDERS

CUSTOM BUILT AT MASS PRODUCTION PRICES

Our 10 years experience in filling the needs of Aircraft and Heavy Industry for Hydraulic Equipment have led us to the engineering and development of this all new line of Industrial Hydraulic Cylinders. Designed especially to meet the most rigid requirements of industry. All are double action with rugged steel construction throughout. Made to take pressures up to 1500 PSI and 3000 PSI. Utilizing standard 'O' rings with leather back-up rings on the 3000 PSI types. Have male clevis mounts on both ends.

We are also equipped to Custom Manufacture to your specifications. Write us Today for further details or expert advice on your problems.

PART NO.	BORE	STROKE	SHAFT	PSI	Type of CAP	THRUST	PRICE
PH34E	3"	4"	1-1/8"	1500	External Threaded	10,500 lbs.	$32.50
PH36E	3"	6"	1-1/8"	1500	" "	"	35.00
PHE1	3"	8"	1-1/8"	1500	" "	"	37.50
PH312E	3"	12"	1-1/8"	1500	" "	"	42.50
PH341	3"	4"	1"1/8"	1500	Inserted	"	32.50
PH381	3"	8"	1-1/8"	1500	"	"	35.00
PH45E	4"	5"	1-1/8"	1500	External Threaded	18,750 lbs.	37.50
PH46E	4"	6"	1-1/8"	1500	" "	"	39.50
PH48E	4"	8"	1-1/8"	1500	" "	"	43.50
PH410E	4"	10"	1-1/8"	1500	" "	"	47.50
PH412E	4"	12"	1-1/8"	1500	" "	"	51.50
PH45E3	4"	5"	1-1/2"	3000	" "	37,500 lbs.	52.50
PH46E3	4"	6"	1-1/2"	3000	" "	"	54.50
PH48E3	4"	8"	1-1/2"	3000	" "	"	58.50
PH410E3	4"	10"	1-1/2"	3000	" "	"	62.50
PH412E3	4"	12"	1-1/2"	3000	" "	"	66.50
PH518I	5"	18"	2"	3000	Inserted	59,250 lbs.	85.00
PH524I	5"	24"	2"	3000	"	"	107.50
PH530I	5"	30"	2"	3000	"	"	130.00
PH636E	6"	36"	2"	3000	External Threaded	86,625 lbs.	265.00

4-WAY, OPEN CENTER HYDRAULIC CONTROL VALVE

Has built-in adjustable relief valve, set at 1000 PSI with a spring loaded neutral position. Used for controlling (1) double action cylinder of the types shown in this advertisement. Can also be mounted in series. Has 3/4" standard pipe inlet & outlet ports. 1/2" pipe thread cylinder port. Shipping weight 10-1/2 pounds. . . . . **21.50 NEW**

NEW-HEAVY DUTY HYDRAULIC CYLINDER

A rugged, heavy duty cylinder. All steel construction. Double action. Has 7" bore. 13" stroke. 2½" steel shaft. Ideal for use in hydraulic presses, leveling ramps, hydraulic tail gates, industrial machinery, road machinery, etc. Shipping weight 180 pounds. . . **95.00**

GB-8-25 TON HYDRAULIC CYLINDER Same as above except has 8" bore, 15" stroke. Will give 50000 lbs. thrust at 1000 PSI. Shipping weight 185 lbs. **105.00**

SAVE UP TO 85% ON GOV'T SURPLUS

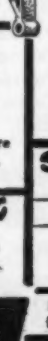
SPECIAL SURPLUS HYD. CYLINDERS

Gov't Surplus Bargain. Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air system cylinder. Has a 4" bore, 18" stroke, 30½" length. Part No. 29. New & Used.

NEW **43.95** USED **29.95**

Part No. 27A. Finest Surplus. For use up to 1500 PSI. Has bore of 3½", stroke 21-5/8", shaft 1". Length 29¾". Ports 3/8" AN pipe. **35.77**

Part No. 27B. Similar to above. Will stand up to 2000 PSI. Has internal stroke cushion in both directions. Bore 3-7/8", stroke 23", shaft 1-3/8", eye-to-eye length closed is 40-3/4". Ports are 1/2" AN pipe. **45.00**



Part No. 27C – Similar to 27A above. Take up to 1500 PSI. Has 3-1/2" bore, 23" stroke, 1-1/2" shaft, 34" closed lgth. 1/2" AN pipe ports. **45.00**

HYD. HAND PUMP

12.75

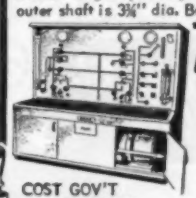
Top condition. Has operating pressure of 1500 PSI. Capacity of 1.5 cu. in. per complete cycle.

HYD. HOSE & TUBING

We stock a complete line of Hydraulic Tubing and Hose as well as all types of fittings and hardware. Send us your requirements.

TELESCOPING HYDRAULIC CYLINDER

Thrust shaft is in two stages. First stage extends 39" – the second stage extends 18". Each stage works seperately. The overall length eye-to-eye is 61½". Inner shaft is 2-3/4" dia. outer shaft is 3¾" dia. Bore is 4¼". Ports are 1/2" AN pipe. **165.00**

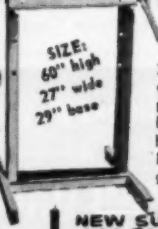


AIR ASSOCIATES HYDRAULIC TEST STAND

Electric motor driven type. Has a 2500 PSI Hydreco Pump which delivers up to 10 GPM. Powered by 15 HP, 3 phase motor using 220/440 volt, 60 cycle current. Unit has selector valves, pressure gauges, flow meter, reservoir, heat exchanger and filter pressure regulator. Mounted on steel frame. Has work bench, flourescent lights and hand operated, high pressure pump for testing to very high pressures. Overall size: 8ft. long x 7ft. high x 4ft. Deep.

COST GOV'T APPROX. $6000 **$1495**

HYD. TEST STAND – Same as above but has a Reeves variable speed reducer to control the pump output as desired. **$1895**



NEW 10 TON HYDRAULIC PRESS

Here is a rugged 10 TON Arbor Press you can use in the shop or take with you on the job. Has sturdy frame of 4" welded channel iron. Press has 4-1/4" stroke, 2-1/2" diameter ram. A control valve operates the piston in both directions. Platform is adjustable. Has positive power Hand Pump. 2000 PSI pressure gauge. NEW **129.00**

SURPLUS VICKERS PISTON TYPE-CONSTANT SPEED-HYD. PUMPS & MOTORS

Made to top Aircraft specifications. RPM shown below is the recommended maximum for constant speed. Quantities limited.

Part No.	Cu. in. per rev.	GPM	PSI	RPM	PRICES NEW	PRICES USED
HYDRAULIC PUMPS						
PF9-713-20BCE	.410	5.3	1000	3000	—	$20.00
PF9-2713-20ZE	.410	5.3	1500	3000	$24.50	—
PF9-2713-10Z	.208	2.7	1500	3000	$29.75	$22.50
PF2-713-25BCE	.507	6.5	1000	3000	$32.50	$22.50
PF50-3915-30YG	1.520	19.7	3000	3000	—	200.00
HYDRAULIC MOTORS						
MF9-713-15A	.310	4.46	1000	3750	—	$18.50
MF9-713-30BCF	.600	9.75	1000	3750	$37.50	—
MF9-713-25BCF	.507	8.25	1000	3750	—	$22.50

STRATO POWER HYDRAULIC PUMPS

Designed and built to finest aircraft specifications.

PART NO.	GPM	PSI	RPM	PRICE EA.
SP-3	2	1400	3750	NEW $27.50
67WF300	3	1500	4500	USED 72.50
67WJ800	8	3000	4500	USED 87.50

NEW SURPLUS VICKERS HYDRAULIC TRANSMISSION

Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic pressure dash pot for smooth control. Power output RPM is 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator set-ups, Conveyors, Drives, etc. . . . **44.50**

4" SPLINE SHAFTS for Input and power take-off on above. $2.50 pair

INPUT & TAKE-OFF PLATE ASSEM. To adapt trans. to pulley drive. Has high speed bearings and 1/2" keyway shaft. Per Set **20.00**

PESCO HYD. PUMP

A gear type pump. Will deliver 2 GPM at 1500 RPM with 1500 PSI – delivers 6 GPM at 4300 RPM with 1500 PSI. Has .375 cu. in. displacement per rev. Ports are 3/4" standard pipe. 5/8" male spline drive shaft. 4" pad mount. In good condition. **14.95**

NOTE: Items shown here are only a small part of our tremendous stocks. We have over 100,000 Hydraulic Cylinders in 106 sizes and types. Also all type Valves, Pumps, Motors.

Order from this Ad. Pay by Money Order or Check. P.O.s accepted from well rated D&B firms. 1/2 Dep. with C.O.D.s. Prices F.O.B.

Palley SUPPLY CO

2263 E. VERNON AVE., DEPT. AH-11 LOS ANGELES 58, CALIFORNIA

Useful Literature continued

tion has released a new 16 page catalog #150. The bellows outlined in this brochure are often available in different metals and a wide range of sizes. Complete specifications as to inside-outside diameters, wall thicknesses and spring rates are given. Typical bellows applications are illustrated in line drawings. Various types of flexible metal hose construction are described with recommendations for their application. Complete specifications and application photographs are featured.

Circle 220 on Reader Service Card

GLASS TRACING CLOTH . . . Newly introduced plastic glass tracing cloth offers fire resistance in addition to dimensional stability. A catalog sheet, prepared by Geo-Optic Company, Inc., describes the new tracing media. Sheets or rolls of 36, 42 and 48 inches width are available.

Circle 221 on Reader Service Card

CENTRIFUGAL PUMPS . . . A complete line of cradle mounted general purpose centrifugal pumps are discussed in a recently published brochure. In this cradle-mounted design, pump and driver are separate units, mounted close together on a single, structural steel base plate and directly connected by a flexible coupling. The pump consists of a rigid cradle which supports the bearings, shaft, impeller and the casing. For a given pressure, capacity and shaft speed, impellers and other parts are interchangeable. The booklet, available from Ingersoll-Rand shows the five basic cradle groups with the corresponding pump types, capacities and horsepower ratings. Special purpose units are also covered.

Circle 222 on Reader Service Card

VARIABLE SPEED TRANSMISSIONS . . . The inner workings of variable speed transmissions built by Sterling Electric Motors, Inc., are discussed in an eight page booklet. Known as Speed-Trol, these units have direct-through ventilation to keep motors cool and clean. They can be mounted in any position. The booklet which illustrates the units and their application describes also the factors in drive selection and presents the many types of automatic and remote speed control accessories available.

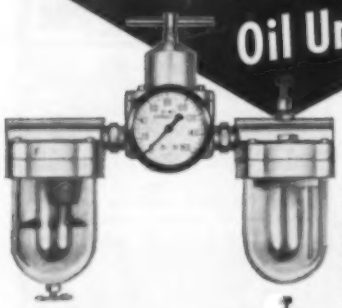
Circle 223 on Reader Service Card

FLEXIBLE METAL HOSE . . . made in bronze, carbon steel, monel, nickel or stainless steel is described in a technical data book U-333 issued by Universal Metal Hose Company. Shown is a complete range of flexible all metal hose types for varied pressure conditions, elevated temperatures and motion. Complete specifications are also presented.

Circle 224 on Reader Service Card

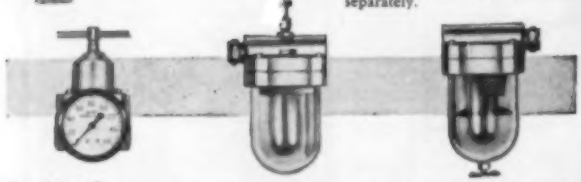
TUBE FITTINGS . . . Crawford Fitting Company has issued a series of charts presenting the variation of load at yield of type 304 stainless steel tubing when held by Swagelok tube fittings. An independent research organization compiled this

AIR-MITE
FILTER—REGULATOR
Oil Unit



- Instantaneous response to demand
- Special Filter for cleaner air
- Accurate injection of pre-atomized oil

The new AIR-MITE unit is designed and built for maximum operating efficiency, easy maintenance and long life Operates at pressures to 160 psi. Available in ¼", ⅜" and ½" T.P. sizes. Individual units available separately.



Regulator—Incorporates piston cup instead of diaphragm. Provides more accurate, stable regulation, lasts longer. Direct reading gauge for close regulation of outlet pressure.

Lubricator – Automatically pre-atomizes and feeds oil mist into air stream. Simple micro adjustment permits accurate balance of oil-to-air supply.

Filter – Porous sintered bronze element filters better . . . won't collapse . . . is easy to clean. Built in air baffle. Brass drain cock.

Write for catalog sheets and prices.

AIR-MITE Devices, Inc.
4415 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

HOLOKONTROL VALVE
WITH
"BUILT-IN RELIEF"

CHAR-LYNN HOLDKONTROL VALVE

Controls Single or Double Acting Systems
Either Full Manual or Holdkontrol Operation
500-2000 P. S. I. Relief

holds in operating position and automatically returns to neutral when pressure relief opens. Valve can be manually returned to neutral, or adjustment allows complete manual operation. Three point reversible mounting, 360° handle positioning, ¾" inlet and outlet ports, handles oil volume to above 12 G.P.M.

Write for FREE Catalog

CHAR-LYNN CO.
2843 26th Ave. So., Dept. AHA, Minneapolis 6, Minn.
Member—National Fluid Power Association

Char-Lynn

Circle 4 on Reader Service Card

Circle 23 on Reader Service Card

information. Complete and accurate test data are shown on 1/2, 3/4 and 1 inch stainless steel tubing in various sizes of wall thicknesses and in pressures at temperatures ranging from room temperature to 1800 degrees F.

Circle 225 on Reader Service Card

INDUSTRIAL PUMPS . . . fluid motors and aircraft-type pumps are featured in a four page catalog 6D-EA. These units, built by Eastern Industries, Inc., are of lightweight construction. Special alloys add toughness and hard wearing qualities. Interchangeability of all parts is easily accomplished. The models illustrated have all engineering specifications and recommended applications listed.

Circle 226 on Reader Service Card

AIR METERS . . . Effective production and economical operation of air operated tools or machines is possible with a unit, known as Tool-Om-Meter, which measures air consumption. With the aid of these meters repairs and adjustments can be made when the meters show that they are needed. A four page folder issued by New Jersey Meter Company, describes the unit and its applications. These meters are constant head, variable area flow meters of the multiple orifice, cylinder and piston type. The metering cylinder has eight or ten rows of accurately reamed orifices. The instrument cannot be injured by a flow in excess of capacity. Installation photographs and specifications are included.

Circle 227 on Reader Service Card

DIAL GAUGES . . . and setmasters are the subject of a brochure offered by the Boice Manufacturing Company. For measuring inside and outside dimensions of machine parts and O-ring grooves, this booklet gives answers to many gauging questions. In addition to giving specific details of the company's line of snap, bore, large diameter and length gauges, the catalog features ruled sketch sheets making it easy for manufacturers to present their gauging problems.

Circle 228 on Reader Service Card

PILOT OPERATED CONTROL VALVE . . . known as Type 10 and recommended for air, light oil, water and non-corrosive fluids is described in a bulletin prepared by A. W. Cash Co. The valve converts from pressure reducing and regulating to back pressure control by a simple switch of control lines. The bulletin includes complete information on the materials available, pressure and temperature ratings, engineering drawings, capacity, performance and construction data.

Circle 229 on Reader Service Card

VACUUM PUMPS . . . Kinney Manufacturing Div. of New York Air Brake Co. has published a 52-page catalog of its complete line of high vacuum pumps featuring an engineering section containing formulae and data. Designated Catalog No. 425, the material contains many cutaway drawings, diagrams, graphs, performance curves, installation data, etc. Sections are devoted to the compound, single-stage simplex, single stage duplex, and two-stage mechanical booster high vacuum pumps. Ranging in size from a ¼-hp unit which has a displacement of 2 cfm to a 40-hp unit having a displacement of 780 cfm, these pumps are designed to create the low absolute pressures required in all fields of modern vacuum processing.

Circle 230 on Reader Service Card

Bellows
HAN-D-AIR CYLINDER

Single Acting Model Illustrated

- SAVES TIME in jig and fixture operations
- SAVES TIME in parts positioning
- SAVES TIME in parts ejection

The Bellows HAN-D-AIR is a small (1⅛" bore), rugged air cylinder for scores of *little* jobs — clamping, feeding, ejecting parts, etc. Choice of single and double acting models in strokes of 1", 2", 3", and 4". Lightning fast, its pressure always uniform, it does the job faster, better, and far cheaper than it can be done by hand. Its compact design makes multiple installations easy. The threaded piston rod connects quickly to work loads. Thrust equals air pressure applied (175 psi max.). Port size: ¼" pipe tap.

FOR FULL DETAILS WRITE DEPT. AH-1155 1306A

The Bellows Co.
AKRON 9, OHIO

Circle 26 on Reader Service Card

ELIMINATE NOISE-SHOCK!

NOW—You can silence your air-operated equipment *and step up worker efficiency* . . .

QUIETAIRE Pneumatic Silencers reduce sound in Noise-Shock areas close to the level found in the average factory (75 decibels). THAT'S IMPORTANT in terms of less worker fatigue – greater productivity – vastly improved morale. QUIETAIRES are small and compact; easily installed, easy to clean. Being all metal, they are rugged, durable, and safe: a lifetime product.

A new folder gives complete information. Write us to send you one!

"PRODUCTION PROVEN"

Quietaires have been produced for the automotive trade in Detroit since 1952. More than 25,000 have been manufactured and sold. C. W. Morris Company, the manufacturer, has produced over 350,000 units of noise dampeners of various design.

Quietaire PNEUMATIC SILENCER

C. W. MORRIS COMPANY
10630 CLOVERDALE • DETROIT 4, MICHIGAN

Circle 97 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Walter J. Holder
Houdaille-Hershey of Indiana, Inc.

C. Wyatt Smythe
Resistoflex Corporation

Thomas E. Zurick
Marsh Instrument Co.

Walter J. Holder has been named central district sales manager for **Houdaille-Hershey of Indiana, Inc.** Holder was previously Chicago district manager and will continue to make the Chicago office his headquarters. The central district includes northern Illinois, Indiana, Ohio Kentucky, Michigan, Wisconsin, Iowa, North and South Dakota.

To coordinate field sales operation, market research, sales forecasting and other activities of the sales department, **C. Wyatt Smythe** has joined **Resistoflex Corporation.** A graduate of Amherst College, Smythe held various sales positions in the wholesale distribution, chemical and plastic fields.

Worthington Corporation's newly established **Harrison Division** announced these promotions. **William C. Osborne** as assistant to the manager of engineering; **Norman L. Myerson** to manager, research and development division; and **Charles A. Macaluso** to assistant manager, research and development division.

Marsh Instrument Company has named **Thomas E. Zurick** sales representative for Kentucky and West Virginia. Prior to joining Marsh's sales staff, Zurick served with Fairbanks-Morse.

Election of **Alvin R. Almquist** as secretary of **Tube Reducing Corporation** has been announced. Almquist was also appointed controller. He has been with the company since 1952, and served as divisional comptroller.

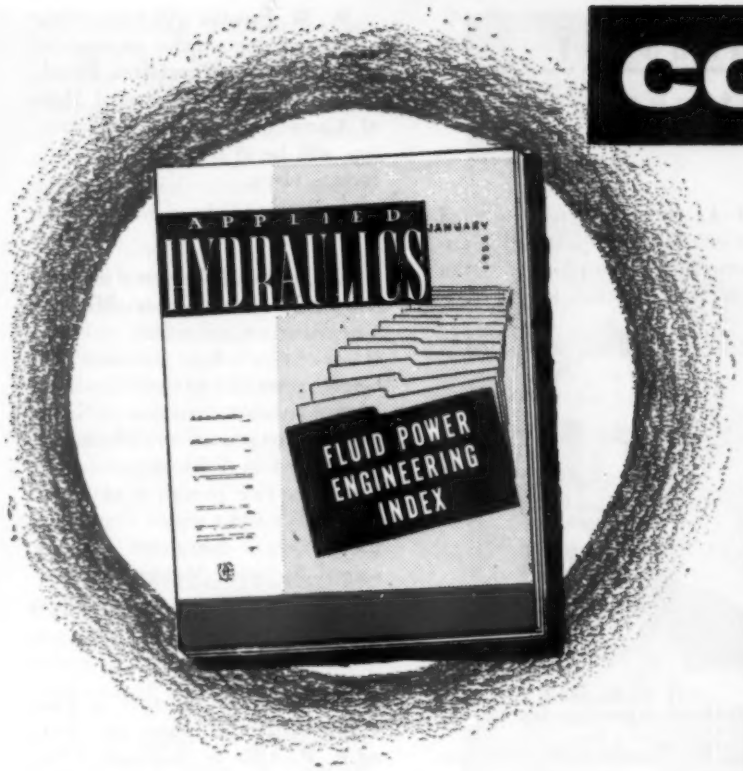
For the past several years industrial sales manager of **The Parker Appliance Company, D. A. Cameron** has been appointed general sales manager for the company's three industrial divisions. Cameron joined Parker in 1941, was a member of the sales force and held several administrative and sales positions. **J. N. Wolfram,** for the last two years administrative engineer has been appointed engineering manager. **Richard S. G. Schmidt** has joined Parker's engineering staff as a rubber engineer.

Chicago Tube & Iron Co., Inc., Chicago, has been appointed tube and hose fittings distributor for Parker Appliance Company. The firm is headed by **H. W. Haigh,** president.

Three new agents have been appointed for the **A. W. Cash Company. I. W. Cotton Company,** Indianapolis, Indiana will cover central and southern Indiana; **Fuel Economy Engineering Company,** St. Paul, Minnesota, covering Minnesota, North

Continued on page 152

COMING!



Your January 1956 issue of APPLIED HYDRAULICS will present for the first time the

FLUID POWER ENGINEERING INDEX

HERE'S AN ISSUE WHICH FILLS A BIG NEED!

Order Extra Copies Now

The January 1956 issue will put an up-to-date fluid power bibliography on your desk where you can use it every day. It will save hours of hunting for information and it may save days of work which might only be a duplication of effort because it can be found in published material. You'll be able to locate published data pertinent to your problem or interest quickly.

25 YEAR INDEX

Twenty-five years of published material relating to hydraulics and pneumatics will be fully indexed and cross-indexed. This material includes: Books, Magazine Articles, Conference and Engineering Society Papers. The index will give designers and users of fluid powered equipment the most complete reference source that has ever been compiled on the subject.

CROSS REFERENCED

An elaborate subject index with cross-reference relating to specific problems, types of application, and types of products or equipment will make it easy to quickly find the sources of information to help you in all areas of your work. A wealth of available design, operating and maintenance experience is represented by the titles and sources found in this index.

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You'll want more than one copy of the January issue. It's sure to be one of your most used references, and in demand by others; therefore, every engineering department will use several copies and you may wish to make this issue available to your friends and customers. Only a limited extra quantity will be printed. To reserve your extra copies fill in and mail the coupon now.

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Post Scripts of Industry

continued

Dakota, South Dakota and northwest Wisconsin; and **Keener Sales Company,** Knoxville, Tennessee, to cover the eastern part of this state. Two Cash agents have changed their firm names. **Quinn, McKerall & Quinn Company,** Birmingham Alabama, was previously McKerall Engineering Company and **Whitlock Manufacturing Company,** Chicago, Illinois, formerly known as Reitz & Weeks Co.

Walter L. Flanders has become works manager of the **Wales-Strippit Corporation.** He was production manager of the company from 1952 to 1954. For a short time before returning to the company, Flanders was production manager for American Machine and Foundry Company.

H. C. Gebhart was appointed chief engineer of **Rockwell Manufacturing Company's** Delta Power Tool Division. He succeeds

H. C. Gebhart
Rockwell Manufacturing Co.

John B. Unterweger who was recently promoted to factory manager. Gebhart was former chief engineer of Kett Tool Company.

W. W. Squire will be working as engineering service representative for **Adel Precision Products, Division of General Metal Corporation.** His headquarters will be at the Burbank, California, plant.

G. Lawton Johnson was elected president of **Greer Marine Corporation,** subsidiary of Greer Hydraulics, Inc. **Edward M. Greer,** president of Greer Hydraulics was named chairman of Greer Marine Corporation, which was established in 1954. Johnson will remain a vice president of Greer Hydraulics and a senior director of the foreign operations wholly owned by Greer Marine Corporation.

The board of directors of **The Louis Allis Company** has elected **E. P. Allis** as chairman of the board and promoted **John W. Allis** from vice president to president.

FOR CLEAN, DRY AIR

Distributing Line Of Cool Air From Receiver Tank
Vapor Free Air Near Point Of Use
Take Off From Top Of Pipe
Replaceable Desiccant

MURPHY TRIUMPH AA SEPARATOR-FILTER
Sizes: ¼, ⅜, ½, ¾; Weight 30 lbs; Pressures: 0 to 125 psi; Price: $71.00 ea; Desiccant refills $1.00 ea.

After precooling and separating compressed air, this small unit, placed close to the point of use will finish the job of removing last traces of impurities.

Where very particular work demands dry air completely free from any trace of oil or vapors Murphy Triumph AA is the answer.

AFTERCOOLERS FOR 10 CFM TO 10,000 CFM—SEPARATORS—TRAPS

JAS. A. MURPHY & CO. INC.
Hamilton, Ohio

Circle 98 on Reader Service Card

Up to 40% higher tightening torques

a feature of new High-Torque Unbrako socket set screws

Compare UNBRAKO-recommended tightening torques with those of ordinary socket set screws and you readily see why you can set an UNBRAKO and then forget it. The reasons are simple. UNBRAKOS have deeper sockets, which give you better purchase with the wrench; rounded socket corners, which eliminate the sharp corners where cracks start; fully formed threads, which make them stronger; and knurled cup points, which keep them tight.

Bulletin 2067 tells the complete story—briefly and pictorially. Ask your UNBRAKO industrial distributor for a copy. Or write us today. STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

STANDARD PRESSED STEEL CO.
UNBRAKO SOCKET SCREW DIVISION SPS
JENKINTOWN PENNSYLVANIA

Circle 126 on Reader Service Card

James Bush, Jr., has been appointed the New England representative of the **R. P. Adams Company, Inc.** Bush will handle the company's products in the states of Maine, Vermont, New Hampshire, Rhode Island and the eastern section of Massachusetts.

Bernard L. Rice has become new sales representative for **Weston Hydraulics, Ltd.,** subsidiary of **Borg-Warner Corporation.** Rice, who will represent the firm in southern California, had several years experience in the aviation business.

Geo. L. Abbott, The Garlock Packing Company's president since 1928, and associated with the company since 1911, was elected chairman of the board and chief executive officer. He is succeeded in the presidency by **Robert M. Waples** who moves up from the vice presidency. **William M. Sheffeld** becomes a vice president.

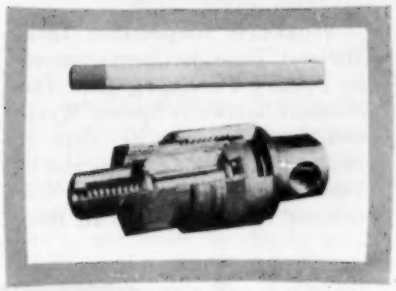
Geo. L. Abbott
The Garlock Packing Co.

Robert M. Waples
The Garlock Packing Co.

Continued on next page

Circle 68 on Reader Service Card

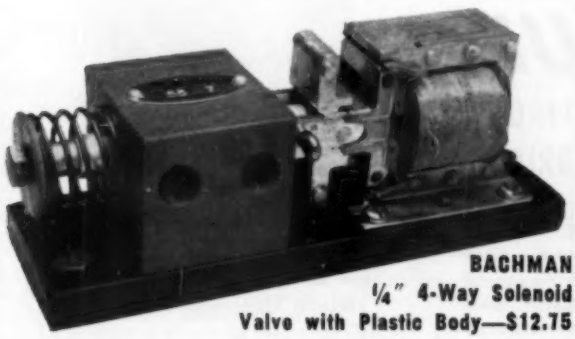
NOW TRY HUSCO
Hydraulic Control-Engineering for Improved Performance, —Space and Cost-Saving



Every Husco Hydraulic Control is custom-engineered for your equipment! We have no "standard" models to push. But our successful experience with hundreds of difficult control problems—confirmed by case histories—promises you the *right* control for your needs . . . Control Valves, Check Valves, Reciprocating Valves, Hydraulic Cylinders, Pumps, Power Units—they're all engineered to your specific equipment demands for size, capacity, performance.

Check HUSCO *first* for precision engineered Hydraulic Units. You'll save time, money and worry. Write for details.

HUSCO **HYDRAULIC UNIT SPECIALTIES CO.**
Pumps • Valves • Cylinders
Waukesha, Wis.



BACHMAN
¼" 4-Way Solenoid
Valve with Plastic Body—$12.75

If you are looking for low cost dependability here is a constant duty direct solenoid valve for 200 psi with ¼" orifice—at a price below most hand operated valves. The body is machined from tough canvas base phenolic with ports perpendicular to the laminations.

These valves give millions of cycles of quiet and trouble-free service because the resilient construction *quietly* absorbs the kind of punishment that damages harder materials.

Stems are hardcoated aluminum and permanently resist wear or abrasion. Seals are standard O-rings.

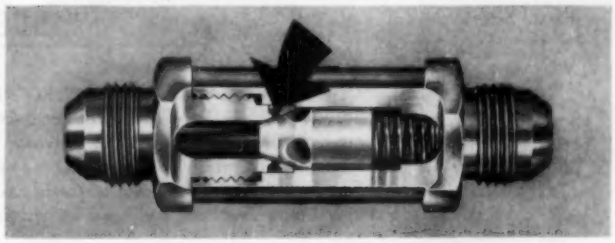
With these units you can operate, check or cushion air cylinders. In air-hydraulic systems they will provide positive check or dwell. Use them for many combinations of manual or automatic control. The valve illustrated is 7" long, weighs 2 lbs. and mounts in any position. Other models have double solenoid and also hand, foot or mechanical actuation. All have ½" stroke with spring return optional.

Let us mail you complete literature or ask us to send you one of these units for a 30 day test and decide for yourself whether this long life leakproof valve can save you money.

JOHN D. BACHMAN & CO.
1713 Sparger Lane — Bristol, Tennessee

Circle 12 on Reader Service Card

The **FLEXIBLE SEAL SEAT***
Simple, Secure, Long-Lasting!



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

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7321 West 59th Street • Summit, Illinois

Kep-O-seal
HYDRAULIC & PNEUMATIC
CHECK VALVES
* PATENT APPLIED FOR

Circle 76 on Reader Service Card

Post Scripts of Industry

continued

Western Inspection, Inc., Midland, Texas, has been acquired by **Sperry Products, Inc.** The company, known as **Sperry Western, Inc.,** will keep its offices in Midland and Odessa, Texas and in Lake Charles, Lafayette and New Orleans, La. Western's **J. H. Binford** continues as president, Sperry's **R. B. Manning** becomes vice president and treasurer and **D. W. Gordon** secretary and assistant treasurer. The board of directors will include **J. B. Earwell,** chairman J. H. Binford, R. B. Manning and D. W. Gordon.

The Industrial Products Division of **Johns-Manville Corporation** will be split into three new operating divisions, the Packings and Friction Materials Division, Industrial Insulations Division and Pipe Division. **Francis J. Wakem,** who was merchandise manager of the Industrial Products Division will be the general manager of the new **Packings and Friction Materials Division.** He will continue as a vice president of the Johns-Manville Sales Corporation. Wakem's staff will include **C. C. Simoni,** general sales manager, **Edward H. Wells,** merchandise manager, both of whom have been elected vice presidents of Johns-Manville Sales Corporation. **P. D. Cannon,** production manager, will continue as vice president of Johns-Manville Products Corporation. The expansion in organization becomes completely effective January 1, 1956.

Francis J. Wakem
Johns-Manville Corp.

C. C. Simoni
Johns-Manville Corp.

W. C. Robinson was named as assistant sales manager of **Tube Turns, a division of the National Cylinder Gas Company.**

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The American Cast Iron Pipe Company of Birmingham, Alabama, is observing its 50th anniversary with the publication of a 52 page book "People and Pipe", picturing the company's operation, past and present. One of the major cast iron pipe producers in the world, Acipco has developed and expanded its operation which now facilitates production of centrifugally spun steel tubes as well as industrial alloy iron castings.

Continental Sales and Engineering Co., representatives for **The Automatic Switch Company,** have moved to 211 Nelbon Avenue, P. O. Box 1505, Pittsburgh 35, Pa.

Donald W. Lenzer has been named sales engineer in the Cincinnati territory by **Darling Valve and Manufacturing Company.** Lenzer will provide sales engineering service in southern Ohio, southern Indiana, West Virginia and eastern Kentucky.

The board of directors of **Lear, Incorporated** has elected **Roy J. Benecchi** a vice president and also appointed him division general manager of the Grand Rapids Division. Joining the Lear organization in 1941 as planning and scheduling administrator, Benecchi later managed the New York sales office and was transferred to Grand Rapids in 1949.

Roy J. Benecchi
Lear, Incorporated

As a result of plans to consolidate and coordinate key administrative and production posts, **Sterling Electric Motors** has appointed **Edgar K. Johnston** as vice president of manufacturing and **John R. Eastman** as chief engineer. Johnston, with Sterling since 1936, previously served as factory manager.

A technical service headquarter in Pittsburgh, Pa. has been opened by **The Texas Company,** in order to expand its specialized services to industry. The announcement was made by Frederic C. Holmes, vice president in charge of the company's Research and Technical Department. This new office, located South, Room 5, Building No. 1, Gateway Center, will be under the direction of **J. C. Van Gundy.** He has been associated with Texaco since 1935.

Ritter Engineering Company, Pittsburgh, Pa., has been appointed a distributor for **The Industrial Actuators and Controls Division of National Pneumatic Co., Inc.**

Continued on next page

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Post Scripts of Industry
continued

Former New York district manager for **Minnesota Rubber and Gasket Company, Richard G. Wells,** has been appointed sales manager of the company. Wells will now supervise the activities of all Minnesota Rubber sales engineers in this country.

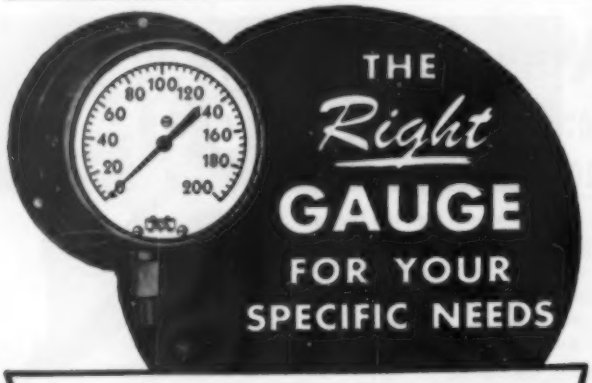
Richard G. Wells
Minnesota Rubber & Gasket Co.

Roy C. Heacock has become director of engineering of **Axelson Manufacturing Company, Division of U. S. Industries, Inc.** He will be in charge of engineering covering machine tools, aircraft products and petroleum equipment. For the past eight years Heacock was associated with Barber-Green Company where he was vice president and director of engineering and manufacturing.

Electro Dynamic Division of General Dynamics Corporation has appointed **John F. Thurston** as general manager. Thurston was previously merchandising manager of the replacement division of Thompson Products, Inc. **Milton E. Hall** who was serving as general manager has become works manager. **Dean W. Paul** will continue as sales manager.

Aeroquip Corporation announced the appointment of **George A. Seaver** as vice president and general manager of **Marman Products Company, Inc.,** Los Angeles, a subsidiary of Aeroquip Corporation. Seaver will be responsible for all sales and manufacturing functions of the subsidiary which manufactures products for aircraft and industrial applications.

George A. Seaver
Marman Products Co.



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Francis L. Maus and **William Keck** have joined the industrial relations staff of **Mullins Manufacturing Corp.** Maus succeeds **C. Robert Conroy** as supervisor of training upon the latters promotion to supervisor of labor relations.

West Instrument Corporation has moved its Chicago factory to its new building located at 4363 W. Montrose Avenue. Original unit of the structure provides over 12,000 square feet on one floor, with every provision for expansion. Air conditioning and humidity control are included to insure uniformity in production of precision instruments.

Carl F. Holland has been promoted to southern district sales manager for **Haoudaille-Hershey of Indiana, Inc.** He will now supervise sales in 13 southern states as well as Missouri, Kansas, Oklahoma and southern Illinois. His headquarters are now in Memphis, Tennessee. **J. D. Weatherford** was named western district sales manager, supervising 11 western states from headquarters in Los Angeles.

Carl F. Holland
Houdaille-Hershey of Indiana, Inc.

J. D. Weatherford
Houdaille-Hershey of Indiana, Inc.

The Hammel-Dahl Company has opened new sales offices in Tulsa, Oklahoma. The new office, located at 310 Thompson Building, is under the supervision of **Paul E. Bowles,** district sales manager.

Kinney Manufacturing Division of The New York Air Brake Company has appointed **W. H. Crowley** to chief engineer in charge of all engineering activities, and **J. Raymond Marshall** to the position of equipment sales engineer.

Globe Machinery & Supply Co. has become Iowa distributor for hose fittings and O-ring seals manufactured by **Parker Appliance Co.** All four Globe branches

Continued on next page

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HYDRAULIC CONTROL VALVE
(Directional)

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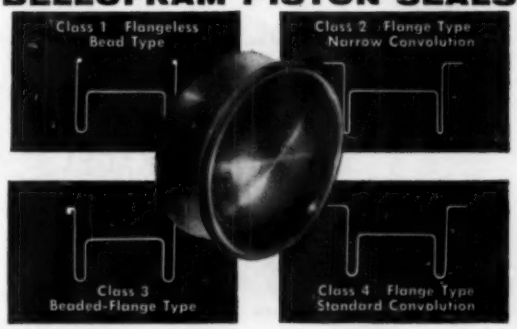
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Post Scripts of Industry
continued

will carry stocks for prompt customer service. These are at Des Moines, Davenport Cedar Rapids and Spencer. Parker also appointed **Dudley C. Jackson, Inc.,** Chicago, Illinois, as distributor for reusable fittings.

To further develop the marketing programs of **Greer Hydraulics, Inc., John T. Robinson** has been appointed sales manager of the products division. Robinson was formerly a marketing consultant with McKinsey & Co.

John T. Robinson
Greer Hydraulics, Inc.

Appointment of **Robert D. White** as branch manager of **Hamilton Rubber Manufacturing Corporation's** New York City activities, has been announced. White was formerly sales manager of Armstrong-Bray & Co.

Marsh Instrument Company has named two new sales representatives. **James G. Kelly** will cover the states of Colorado, Iowa, Nebraska and Wyoming. **Mansur Storrs** will serve the territories of Maine, Vermont, New Hampshire, Connecticut, Rhode Island and Massachussets.

Mansur Storrs
Marsh Instrument Company

James G. Kelly
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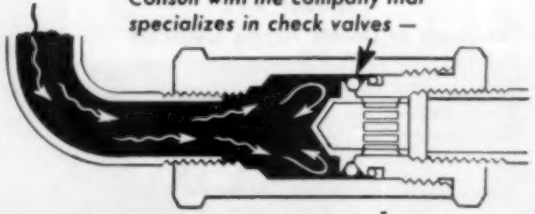

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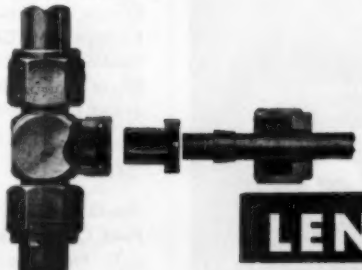

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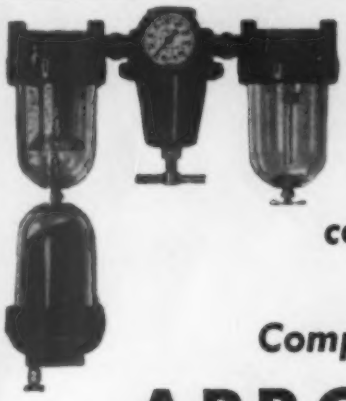

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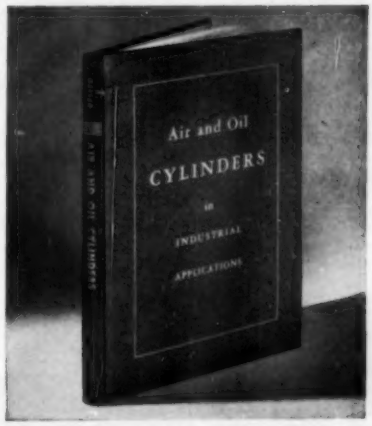

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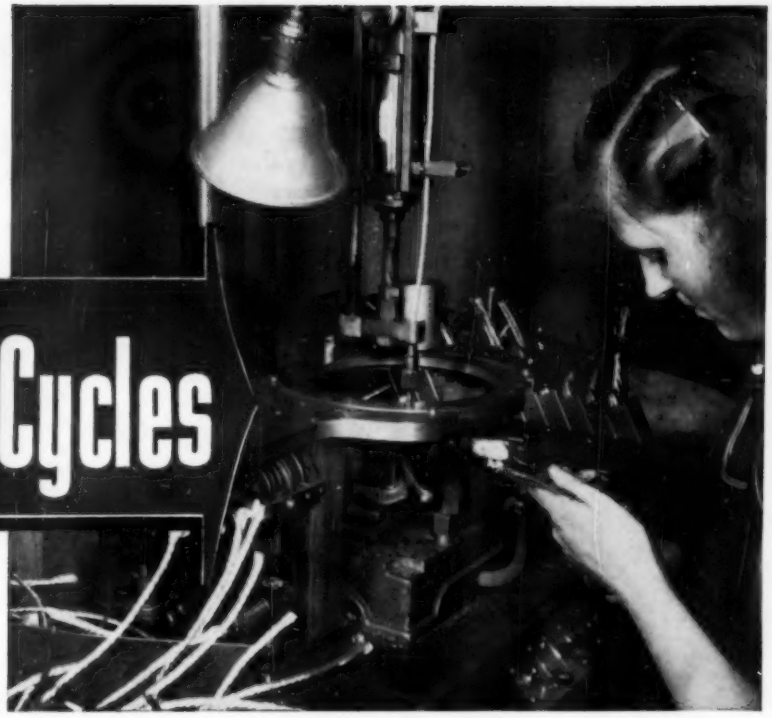


...in an atmosphere laden with carbon dust

Carbon dust is highly corrosive. Few air cylinders can withstand its ruinous effects. But the Bellows Air Motor — the air cylinder with the built-in valve — has completed more than 31,000,000 cycles in the plant of Electronite Carbon Co., Philadelphia — and is still going strong.

But the exceptional durability of the Bellows Air Motor on this installation is only a small part of the story.

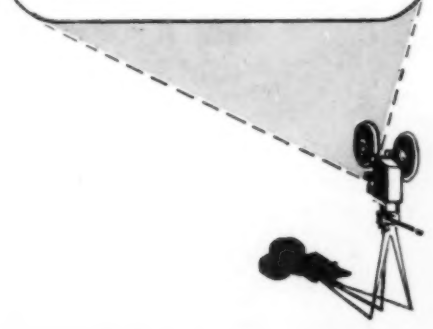
This special machine, designed and built by Bob Silver, Electronite's Chief Engineer, uses a Bellows Air Motor to tamp wire shunts into carbon brushes. And in brushes, shunt contact must be perfectly matched to assure uniform distribution of current load. The Bellows Air Motor provides the day-after-day repetitive accuracy required for constant uniformity. Rejects dropped from 10% to one-half of 1%.

And, in addition, as Bob Silver put it, "We get at least two to four times the speed of production using the automatic method."

The Bellows Air Motor and its related "packaged" power units: rotary and linear work feeders, work holding devices, drill units, etc., make tool-room design and construction of special production machines practical and inexpensive for both long and short run operations — multiply fractional savings into an impressive cost reduction figure.

OPERATION PUSHBUTTON

The story of Electronite Carbon Co. is but one of many dramatic uses of "Controlled-Air-Power" featured in the new motion picture, "Operation Pushbutton." This half-hour 16 mm sound picture shows how industries all over the United States and Canada are applying engineer ingenuity to production processes. We'll be happy to arrange a showing for you. Write The Bellows Co., Dept. AH 1155, Akron 9, Ohio, or phone your local Bellows Field Engineer.



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THE EDITORS OF
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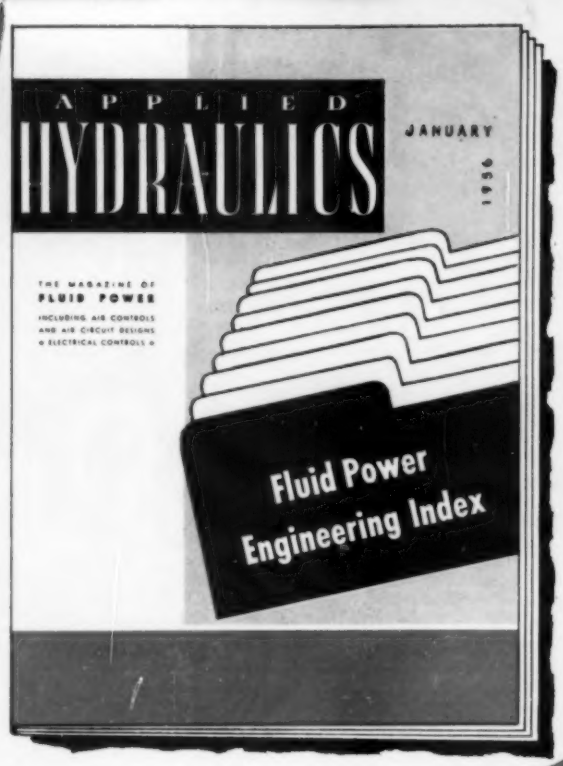
ANNOUNCE AN
IMPORTANT CONTRIBUTION
TO THE FLUID POWER INDUSTRY



FLUID POWER ENGINEERING INDEX ISSUE of Applied Hydraulics (January, 1956)

It will be presented in the January 1956 issue of Applied Hydraulics providing the most complete bibliography or engineering reference ever published in the field of Fluid Power.

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